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EDITED BY T. C. MARTIN AND W. D. WEAVER.

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BETWEEN TWO JANUARIES.

Just about a year ago Mr. Marconi was fêted in this city by the electrical engineers because he had signalled the "S" across the Atlantic. For an Italian whose language ignores the "S," and for an s-repelling telephone in the coherer circuit, that was a pretty considerable achievement, worthily celebrated. Last week, as our current columns record, Mr. Marconi was again dined in distinguished environment in New York because he had succeeded by dint of hard work and true inventive genius in jumping the whole alphabet, from shore to shore of the great Ocean around which hitherto the larger part of the effort of the Caucasian race has been concentrated. This latest work of Mr. Marconi is, indeed, something for universal congratulation, and we can only hope that it will stir up American inventors to see if they cannot beat him at his own game. It is pleasant meantime to note his courteous recognition of the cordial attitude toward him and his work of the American press and people. There is, indeed, a curious contrast between that attitude and the position of Mr. Marconi's own half-fatherland, Great Britain. The surly, glum demeanor of the technical press there is not without counterpart in the position of some leaders in electrical science. For example, in his really superb and suggestive address before the English Institution of Electrical Engineers, President Swinburne says: "We can get but few telegraph papers now. This is not because telegraphy is dead; it is because most of its problems are solved, so there is little to discuss." We rub our eyes; or at least, we beg Mr. Swinburne to wake up and rub his. Surely this utterance is not worthy of so keen and alert an intellect, when the great aerial spaces of the world are being spanned by streams of wireless telegraph messages, that must in short order affect profoundly the whole telegraphic industry! The probability is, not that the English mind is hampered and prejudiced by its cable investments, but that it believes Germany is entitled to the credit of it all, as a practical new art, instead of the plucky, steadfast, keen-witted Anglo-Italian, who now receives thanks for his work from the Congress of the United States.

The greater lies before. Mr. Marconi has done much, but even as we write he is discussing the conquest of wider spans of ocean, and training the ether to quiver to a longer thrill from his "thunder stations." A year ago it was St. John to Poldhu, and now it is Cape Breton and Cape Cod, the stride increasing hundreds of miles at a time; and yet only four kilowatts are needed for the jump, which we fancy compares very well with the efficiency of land telegraph and telephone lines as power transmission circuits. Just where all this is going to end we don't know. Tesla said ten years ago that power in big blocks could be loaded onto the ether for safe delivery elsewhere in express packages; and as we watch the work of Marconi, Pupin and Hewitt, the far-thoughted prophecy comes once more to mind. In the meantime, projects are afoot for wireless routes between England and her southward dependencies and colonies; between Italy and the Argentine Republic; and we expect to see them plotted out in the ether like steamship lanes in the great seas. But first of all, getting down to business, we are yearning to use the Anglo-American aerial line at ten cents a word; and Mr. Marconi cannot hurry up too much to please the whole impatient Yankee public in providing it. When all is said and done, we might as well rest right now on Hertz's fundamental work, philosophically considered, unless commercial service can be established. But unless all indications are wrong, we shall soon have it.

THE NORTHWESTERN CONVENTION.

The convention of the Northwestern Electrical Association last week was of the usual value and interest to the owners and operators of small central stations in that territory. It is too bad that there cannot be more local organizations of this character scattered over the country, because they cater to the needs of the very numerous small central stations as the larger national organizations cannot. Whether anything will come of Secretary Mercein's hint, that in the future the various local electric light associations of the country may see fit to become a part of one great national organization, say the National Electric Light Association, cannot be foreseen at present. So far, these associations have got along very well without any organic connection or affiliation, and many belong to several organizations without finding that one interferes in any way with another, as each caters to a certain class of needs.

The main object to be gained by making the local organizations branches of the national would be to prevent a certain amount of overlapping of territory which seems to exist in the Middle West. For example, there are electric light associations in Ohio, Illinois and Iowa. The Northwestern Association at the present time is practically confined to Northern Indiana, Northern Illinois, Minnesota, Northern Michigan, but is mainly a Wisconsin organization. There has never been any real clash as to territory between the Northwestern and the smaller State associations, although the State associations have undoubtedly tended to draw attendance and membership from the Northwestern. It is a good deal to ask of the small central station companies to send men to both the State and Northwestern conventions. Therefore, as said before, the main object of a consolidation of interests, as proposed in a tentative way by Secretary Mercein, of the Northwestern Association, would be distinctly to define territory for the smaller associations and prevent the burdening of the small central stations in any territory with an implied obligation to attend several conventions. As to any conflict between the national and local organizations, there can be none, because the national convention will always naturally be attended by the best from the different States. The advantages of membership in it will always more than compensate for the increased expense and time taken up in attendance, as far as the companies likely to send men to it are concerned. There will necessarily be many small companies which will not send men to the national convention, even though, with the present sliding scale membership fees, they can afford to become members, and take part in proceedings at a distance.

One movement started at the convention last week seems likely to spread until it becomes a national one among electrical interests. We refer to the standardization of sizes of advertising literature. The sizes adopted by the Northwestern Electrical Association are in such common use that there can be little objection on the part of advertisers to adopt them. Indeed, there is no doubt but that the majority of advertisers will reason that there can be no harm in making their literature standard size, and that it may do them a great deal of good, and will at once adopt the standards specified. This is a matter which electrical interests might well have taken up long ago; and now that the Northwestern has made the start other electrical bodies should fall in line. Since the committee having the matter in charge (which committee, by the way, has given the matter very careful and exhaustive consideration) has been continued for another year, it is to be expected that at next convention suggestions will be made as to uniformity of classification of headings for convenience in filing.

As to technical electrical matters, the convention served to bring out little that was entirely new, although the paper by Mr. Ryan on "Modern Illumination" brought out several facts and introduced some comparatively new devices with which all central station men should become acquainted thoroughly, since they have so important a bearing on a station's business. The paper by Mr. Wirt, while primarily for the object of introducing a new device for automatic voltage regulation, was also useful in calling attention to the importance of good voltage regulation on incandescent circuits, a matter which is sadly neglected by small electric light companies, and desperately struggled with by the larger ones. Prof. Shepardson called attention to the great number of details which need checking up around a small plant and are worth going over carefully by the owner of the small station, who imagines that all his sources of loss have been stopped, or that there is no room for improvement with existing apparatus. Papers of this kind have been read every year since the association started, but they are just the kind that are needed to set the manager thinking as to where improvements are possible.

THE RHODES SCHOLARSHIPS.

Within the past week have been taken the initial steps toward putting into effect the beneficent project of the late Cecil Rhodes for international scholarships at Oxford. Dr. Parkin, agent of the trustees of the Rhodes fund, has been in close conference with representatives of New England education, with a view of formulating a coherent plan for the administration of the trust. Before a decision is finally made, Dr. Parkin will round up the English-speaking world, but the preliminary discussion is of importance in directing the spirit of the work. The conception of the empire-builder was little short of a stroke of genius to bring together at his Alma Mater forever a band of picked men from the blood brotherhood of English folk; but their choosing is no simple matter. It involves the very fundamentals of our theory of education. For thirty years American educators have been canonizing the German universities, have caught their form without their spirit, and have half forgotten that England has institutions of learning at all. They have copied with Chinese laboriousness the minute specialization of the Teuton so thoroughly as to undermine the very foundations upon which it should rest by an extension of the process. Oxford and Cambridge, with their rich traditions of learning and their splendid monuments of achievement, have been half forgotten or mentioned lightly as survivals of an outworn past. But the Rhodes scholarships bring us face to face with English ideals in higher education, and we must gain at least a wider view from this broadened horizon.

The year 1904 will see near five-score young Americans in residence at Oxford, and their selection ought to be a matter of national interest and pride. From the single standpoint of technical education the immediate result may not be great, for Oxford has never been a notable technical center, but the indirect effect of a powerful stimulus from other than German sources cannot fail to be beneficial. As to methods of choosing the Rhodes scholars, the New England conferences are significant. The consensus of opinion was in substance that candidates should be between nineteen and twenty-three years of age, should have completed at least the sophomore year in an American college, and should pass the regular Oxford entrance examinations. These requirements look simple, but they are of no small significance. If the American bachelor's degree were given after two or three years' study, what would be its probable importance as compared with entrance at Oxford? To the apostles of sham and promoters of humbug who stand for the degradation of the A. B. degree, we commend the cool judgment of the best educators in New England that the American student should have ended his sophomore year before entering Oxford Uni-

versity. And where will be the American who has dodged his Greek, shirked his Latin, and slunk away from his mathematics, when he faces the Oxford examiners? We hold no brief for the classics, but they have a value in grinding in the principles of thorough study; and whatever equivalent Oxford may ultimately be willing to accept for them, that equivalent will not be the amorphous and invertebrate thing that it has come to be in too many American colleges. Sound higher education even in technical subjects must have a deep foundation, and the grim examination system of the great English university will have a salutary effect.

More than this. In States where there are several colleges, it was judged wise that nominations to Rhodes scholarships should be made in order of seniority by such institutions as the Rhodes trustees may consider fit to qualify students for matriculation at Oxford. This provision we earnestly hope will be finally adopted and vigorously enforced. We can imagine nothing better for American education, technical or non-technical, than the sifting that will be accomplished if the Rhodes trustees do their full duty. The petty institutions that rejoice in high-sounding titles cannot be eliminated or graded into efficiency by purely American influence. They are like quack doctors—none is so reprobate but that others will rally to his defence under the stimulus of a common fear. But a searching examination from without can do wonders in separating the good from the indifferent and the bad, and in helping the two last-mentioned classes to the road of reformation. The sifting process may make some strange disclosures. It is not always the institution with the most students or the most vigorous advertising staff that does the best work. It is thoroughness that counts, whether the students are few or many; and thoroughness is not a function of funds, members or doctrinal soundness. If the requirements of the Rhodes scholarships can be made the touchstone of academic efficiency, the gift of Oxford's great son will serve even a mightier purpose than he had in mind. In any event, the effect of the English influence on our American ideals of education will make itself felt as has never before been possible, and will inspire a broader view of intellectual life. Conversely, the presence of those American lads in England can but prove a leaven that should work for good, in strengthening international relationships and promoting a better mutual understanding, not only on questions of education, but matters of national characteristics and tendencies.

TRANSPORTATION IN GREAT CITIES.

The important report of Mr. B. J. Arnold to the municipal authorities of Chicago, to which we have already made brief reference, falls in with a most interesting account of the preparations for rapid transit in Greater New York just published in *Harper's Weekly*. We have seen many discussions of plans for metropolitan rapid transit, but none that spoke so convincingly as the bird's eye view shown by our contemporary. Mr. Arnold divided urban systems of transportation into three classes—the peninsular class, with water front on both sides of the district served; the valley class, with the territory cut in twain by a river; and the radiating class, with a great stretch of territory on one side of the water front. To the first-named he assigned New York, and yet looking at the subject broadly, this city really belongs to the third class, complicated by all the untoward conditions associated with the three. The great business interests of the city, and the nation as well, center in Manhattan Island, but the population which does business there lives for the most part, if within the insular limits at all, so far toward the north as to be for most purposes a separate community. Residential New York in the broad sense lies mainly beyond the Harlem and the East Rivers. New Jersey, too, holds no mean part of the real population of the city, a part which never gets into the census, but which is just as truly of the metropolis as if it were domiciled in Brooklyn. Could New York extend the grasping talons as has Chicago, its population would press close to London's, though New York can never be America in the same sense that London is England.

This outstretching of population beyond two rivers adds to the situation in New York a complication not found so far as we are aware in any other large city. The Thames, the Seine, the Chicago, are rills compared with the East River. The enormous cost of bridges and tunnels blocks the way that would be easy in dealing with smaller streams. Traffic is, therefore, terribly constricted at important points, and however good the transit facilities at these points may be made, the traffic converging upon the termini of tunnels and bridges is tremendously difficult to handle. Hence comes the need for the three-story transportation system now in process of evolution. Intrinsically it is bad; practically it can hardly be avoided. The adoption of electric traction, which alone makes an elaborate tunnel system practicable, has brought incalculable relief to the situation. The splendid projects of the interborough system, the entrance by the Pennsylvania Railroad under the Hudson to the heart of New York and more than all, the prospect of through suburban trains clear down town from the New York Central, will work a revolution that is scarcely possible to realize. It carries out what is really the fundamental principle of successful urban rapid transit—the multiplication of distributing points. The central position of the proposed Pennsylvania station, for instance, will make it a great independent center of suburban traffic relieving the pressure on the rest of the system. With a proper express service to the Battery, part of the burden of distribution will fall on up-town cars instead of adding to the present congestion. In short, whenever the suburban traffic of a city can work to distributed termini, rapid transit becomes relatively easy, while any attempt to concentrate it at a single point leads to disaster. One of the great advantages of Chicago in the matter of rapid transit is the scattering of termini that breaks up any single general direction of travel, so far as the large suburban lines are concerned.

From Mr. Arnold's report this advantage as regards the steam lines is more than offset by the ineffective state of the surface system. This is a conglomerate of cable, electric and horse cars, without adequate opportunity for common use of tracks, and consequently there is as regards the nearer portions of the city extreme congestion. Part of the trouble is laid by Mr. Arnold upon the old policy of giving franchises to different companies for different divisions of the city. There are certain very obvious advantages in having all the rapid transit facilities under a single control, but we think Mr. Arnold attaches too much importance to them. No private monopoly ever was or ever will be administered on altruistic principles, and while some of the practical problems of transportation can be the more easily worked out when all the lines are owned by one corporation, the only safety of the people lies in the iron-compelling hand that can wring good service from one company or several, willing or unwilling. If ever warring companies realize that they must sink their differences far enough to unite in giving proper rapid transit facilities or else be forced out of business, the dove of peace very suddenly begins to brood over their respective general offices. Chicago has done exceedingly well to take counsel with so competent an engineer as Mr. Arnold, and we earnestly hope that its municipal authorities will have the power and inclination to put his ideas in practice. American city governments are generally too weak to take up these important matters with power and purpose, not to say too unstable and sometimes too corrupt to be trusted with them; but the best results can be reached only by a unity of design and administration that are generally not to be obtained save by radical and sweeping changes such as only far-sighted municipal action can secure.

Right of Compensation When Franchise to Maintain Electric Wires is Revoked.

According to a decision just rendered by the Supreme Court of Massachusetts, the owners of electric wires in the public streets have no right to compensation when the franchise to maintain these wires is revoked by the Legislature. Two cases, that of the New England Telephone & Telegraph Company *vs.* Boston Terminal Company, and that of Boston Electric Light Company *vs.* Boston Terminal Company, were decided in the same opinion. Each case arose on a petition for an assessment of damages for conduits and manholes located in certain public streets that were discontinued and taken for the new South Terminal Station, by an act of the Legislature in 1896. The electric companies each had wires in their conduits beneath the discontinued streets, and these wires were removed, but the conduits and manholes could not be removed without their destruction. The rights of the electric companies to maintain wires in the discontinued streets had been derived from certain ordinances of the City of Boston, whose authority to pass these ordinances was not questioned. Some of the ordinances expressly stated that the privileges granted by them were subject to amendment or repeal, but other of the ordinances were silent on these points.

The court says that the privileges granted by these ordinances are all subject to repeal whether there is an express provision to this effect or not. It is fair to presume that these ordinances so far as they did not contain provisions for their termination were in terms perpetual, this being the regular and general form by which rights to maintain wires in the public streets of Massachusetts are granted. The most striking view put forward in the opinion of the court is best expressed in its own words: "A person who walks or drives through a public street does it as one of the public, and not in the exercise of a private right of way. The permanent constructions above referred to (conduits, etc.) are permitted because they are used by the public or a part of the public, or are held and used in private ownership for the benefit of the public. The rights in the streets which are so exercised or enjoyed are not private rights of property, but are a part of the public rights which are shared in common, although used and enjoyed in different ways by the different members of the public who pass through a street, or whose property is carried through it." Having held that the electric companies maintained their wires and conduits in the streets simply as members of the public, the court passes on to the necessary conclusion that the public rights so exercised are subject to the supreme power of the Legislature. The electric companies acquired no property rights in the streets when they erected their wires and conduits there under the ordinances, and these wires and conduits remained personal property, which the companies may remove when the streets are discontinued. As the electric companies acquired no property in the streets, and as they lost their public rights in these streets by legislative action, they could not recover against the terminal company which took the streets. This case brings out strongly the doctrine that the franchise to maintain wires in the public streets is terminable at the will of the Legislature, or of municipal bodies to whom its authority is delegated, even though these franchises are granted in terms that are on their face unlimited. In some other States the franchises granted by municipal bodies to public service corporations to occupy the streets with their structures are held by the courts to be binding contracts, when once acted on or accepted, which neither a municipality nor the Legislature can annul. A strong case supporting this view is that of People *vs.* O'Brine et al., III, N. Y., 1, decided by the New York Court of Appeals in 1888. This case involved the power of the Legislature to revoke a franchise previously granted the Broadway Surface Railroad Company to lay tracks and operate cars on Broadway between the Battery and Fifteenth Street, by New York City. The railway company had accepted its franchise with the condition that a sum of money be paid annually to the city, but these payments were to continue while the franchise was enjoyed. An annual payment of this sort seems to differ little in its nature from conditions often attached to franchises in Massachusetts, as that a street railway shall lay a certain kind of pavement along each side of its tracks, or shall keep the roadway clear of snow. The Broadway company laid its tracks in 1885 and ran its cars over them until the 4th day of May, 1896, when the Legislature revoked its corporate charter. The action under consideration was brought by the Attorney General against the receiver of the Broadway company and others to secure a decree that the franchise to operate a railway on Broadway had been forfeited along with the corporate charter by the Legislative act, as was its plain intent. No limit as to the time of its duration was named in the grant of the franchise to the Broadway company, and the court held that a binding contract for this franchise in perpetuity was completed when the company accepted and acted on the grant. The court further said: "It is, however, earnestly contended for the State that such a franchise is a mere license or privilege enjoyable during the life of the grantee only, and revocable at the will of the State. We believe this proposition to be not only repugnant to justice and reason, but contrary to the uniform course of authority in this country." After this the court went on to hold that the Broadway company had a property right in its franchise to operate a railroad on Broadway which right survived the repeal of the corporate charter and remained for the stockholders or creditors of the company. Furthermore, the decision was that the State had no power to revoke the franchise which had been granted by the city. Much of the apparent conflict between the Massachusetts and the New York cases is due to the fact that the New York court is able to find a binding contract in one state of facts, while the Massachusetts court in a very similar state of facts sees only the exercise of a privilege enjoyed at the will of the Legislature. If a Massachusetts franchise can be secured as part of an undeniable contract, the court will no doubt protect it from legislative revocation.

Latest General Electric Combination.

Various reports and rumors have been noted in these columns as to the important proposed combination between the General Electric and Stanley Electric Companies. These reports have been renewed with great persistence during the present week, and General Electric stock has advanced several points in Wall Street on the strength of them. We should not like to assert that the "deal" has already been consummated at this writing; probably it has not; but the parties directly interested are naturally not inclined to say much one way or the other. The subjoined is a fairly good synopsis of the statements enjoying circulation in the newspapers, and presenting the known facts and plausible inferences affecting the situation:

The Stanley company was practically controlled by the Roeblings until the Whitney-Widener-Elkins syndicate purchased it, that syndicate being already deeply interested in the Electric Storage Battery Company of Philadelphia. They offered the Battery Company to the General Electric Company at a price over $100 per share. On the market the stock was quoted around 90.

Soon after this the Stanley Electric Company was purchased by those interested in the Electric Storage Battery Company. The electrical appliances required by the New York and Philadelphia traction companies had been furnished by the General Electric and the Westinghouse companies, and it was suggested that the Stanley plant would be enlarged so as to furnish all the necessary appliances. The General Electric Company is said to have intimated that it might go into the business of making storage batteries, and certainly did look up the subject.

Strong financial interests identified with the General Electric and friendly to both parties here stepped in and counselled peace. The acquisition of the Stanley by the General Electric was suggested, negotiations were begun, and continued to what seemed a conclusion, when for some reason not entirely apparent they were dropped. It is said the Stanley price was much too high. They were resumed a short time ago and are said to have been carried to a satisfactory conclusion, the details of which will soon be announced, unless the unexpected should happen.

It has been generally understood that the present deal had to be concluded by March 2, since the Brush fundamental patent of the Electric Storage Battery Company expires on March 3. It has been claimed that, with this patent out of the way and certain other patents circumvented, storage batteries could be manufactured and sold at less than 8 cents a pound, while they are now selling at from 20 to 25 cents a pound. By a deal with the General Electric Company the Electric Storage Battery Company on other patents might, it was argued, still preserve its strong position in the field and competition would not be an easy matter. A meeting of the Stanley stockholders has been called to increase the capital from $2,000,000 to $10,000,000, but this increase will have no effect on the consolidation now on foot. If all one hears is true there might be a general holding or securities company, with affiliations even outside the strictly electrical field.

26,000-Volt Installation at Grenoble, France.

BY C. L. DE MURALT.

HIGH-TENSION plants are multiplying in Europe and one of the most interesting new installations of this kind is the plant of the Société Hydro-Eléctrique de Fure et Morge, near Grenoble, France, supplying electricity for power purposes to a number of factories situated in the valleys of the two rivers Fure and Morge, from which the company takes its name.

The water power is taken from the River Drac, a tributary of the Isère. It has a fall of about 21 ft. per mile and its flow varies from 7,000 cub. ft. at low water to 42,000 ft. at high water, but the mean flow is about 11,000 cub. ft.

Near the Pont de la Rivoire, about 11 miles from Grenoble, there is a stone dam across the river about 165 yards long. From there a canal of about 660 yards length brings the water to a reservoir with a total surface area of about 1,000 square yards and some 4 to 5 yards depth. This reservoir is divided into two compartments. The first one is destined to keep back the sand carried along by the water, and special openings are provided in the wall for periodically cleaning it and returning the sand to the river. An overflow separates the first from the second compartment, which is in direct communication with the conduit. The latter is built in the form of a tube, 130 inches in diameter and three miles long. The first 1½ miles of the tube is made of armored concrete, while the remainder consists of a steel tube. The central station building covers a total area of about 1,200 square yards. It is situated about half a mile below the confluence of the Drac and of the Romanche and some 8 miles above Grenoble. The main machinery room is 48 yards long and 13 yards wide and amply lighted by a row of large windows. A crane of 15 tons capacity runs along the whole length of the building in order to facilitate repairs and inspections. In the basement immediately below the alternators there is a vaulted gallery containing the cables which connect the generators to the switchboard.

Next to the main room and at a somewhat lower level is the transformer room provided with a system of water pipes under pressure for the artificial cooling of the oil baths of the transformers. A small truck running on rails in front of the transformers allows the easy handling of the latter and their transportation to a special little repair shop placed at one end of the transformer room and provided with a 10-ton traveling crane.

Above this on the first floor is the switchboard in the center, the offices and store rooms to the right and the living rooms of the station superintendent to the left. All the foundations of the building are made of concrete and about 48,000 cubic feet of the latter have been used for this purpose.

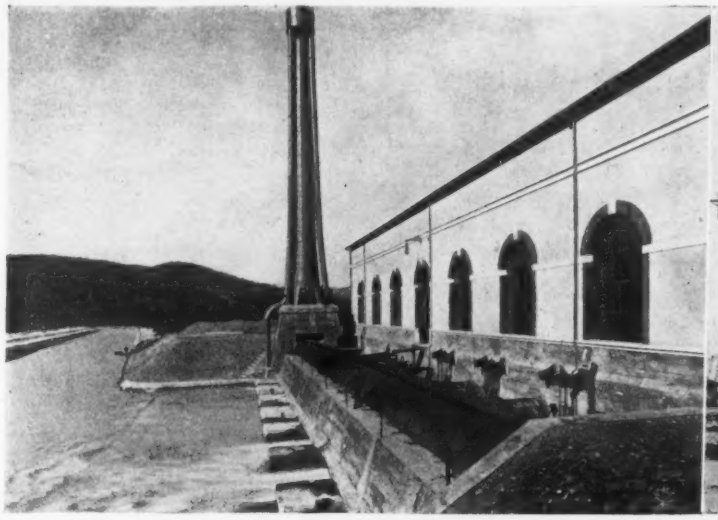
The station contains at present five turbo-alternators of 1,350 hp each, two turbo-exciters of 150 hp each and a small 5-hp turbine destined to provide the hydraulic pressure necessary for the turbine regulators. Figs. 1 and 2 show outside views of the power house, whilst Fig. 3 gives a good idea of the interior of the main machinery room. The turbines were supplied by Neyret-Brenier, of Grenoble. They are of the centripetal type with cylindrical distribution and they work with 15 feet of draft tube.

They are coupled with the alternators by means of elastic couplings. The speed of the turbines is 300 r.p.m., and they use something like 40 cubic feet of water per second when working under full load.

Three of the turbines have automatic regulators and are provided with compensating valves in such a manner that when the regulator shuts off water from the turbine it opens at the same time by a corresponding amount the compensating valve, thus keeping the quantity of water used by the turbine constant, the 40 cubic feet passing either through the turbine proper or through the opening in the compensating valve. The flow of the water in the pipes is therefore very regular.

The three-phase, alternating-current generators coupled to these turbines were furnished by Brown, Boveri & Co., of Baden, Switzerland. Each of the five alternators installed at present is capable of absorbing continually the 1,350 hp furnished by the corresponding turbine, and of developing 930 kw when working on inductive loads with a power factor equal to 0.8. They are designed for an e.m.f. of 3,000 volts at 300 r.p.m. and for a periodicity of 50 cycles per second. Transformers are used to raise this tension to 26,000 volts for distributing purposes.

The station has been arranged in such a manner that one generator forms, together with its transformer, a group normally indivisible, i. e., each alternator can under normal conditions only work with its own transformer. This arrangement has been chosen in order to simplify as much as possible the switchboard and all the connections, which is a very important point for any central station using high-tension currents. Besides, as there is always one entire group in reserve in this station, there is in this case no disadvantage connected with the arrangement just described.



FIGS. 1 AND 2.—OUTSIDE VIEWS OF THE GRENOBLE POWER HOUSE.

The alternators are of the type with fixed armature and revolving interior field, the latter containing 20 poles, corresponding to 50 cycles for 300 r.p.m. The current for their excitation is furnished at 110 volts by separate exciters. The armature is carried by means of two feet on a cast-iron bedplate, which extends on both sides into the two main bearings. The high-tension winding is placed in completely closed tunnels punched into the armature core, and insulated from the iron by means of seamless micanite tubes which are tested before use under double the normal pressure.

Each generator has an output of 223 amperes per phase for $cos\ \phi = 0.8$ and 180 amperes for $cos\ \phi = 1$. The interior diameter of the armature is about 88 inches, the external diameter of the generator being about 135 inches. Each machine weighs about 30 tons.

Each of the two separate exciters is coupled to a 150-hp turbine and has an output of 100 kw. Each one can supply besides the energy necessary for the simultaneous excitation of the five alternators, all the energy needed for lighting the whole building and the switchboard. The other exciter is always kept in reserve.

These machines have four poles and a drum-wound armature

with machine-wound coils placed in open slots. At 500 r.p.m. the normal output of one machine is 870 amperes at 115 volts.

Each transformer is made up of three columns of sheet iron connected at bottom and top by two cross pieces. Each column is fitted with a series of high-tension and low-tension spools of cylindrical shape separated from one another by means of a vertical insulating cylinder. There are six high-tension and 16 low-tension spools, which subdivision of the windings has been chosen in order to facilitate repairs.

The whole transformer as described above is completely immersed in an oil bath formed of an elliptical iron tank, 75 x 30 inches filled with oil. The principal object of this oil bath is to ensure a more perfect cooling than would be the case with ordinary air-cooled transformers. In order to heighten the effect and to make the cooling still more efficient, a spiral water pipe is placed in the upper part of the tank and water is continually allowed to flow through this for cooling purposes. The transformers are of

The switchboard is divided into three principal parts, as follows:

(*a*) The first one, which carries all the measuring instruments and from where all the different switching operations are effected, constitutes the switchboard proper. This part is mounted on a balcony on one of the long sides of the machinery hall, and as it is accessible to everybody it only contains such parts as carry low-tension current.

(*b*) The second part, containing the 3,000-volt switches and fuses, as well as the measuring transformers, is situated immediately below the first one between the floor and the balcony. Thus it was possible to chose an arrangement by which the switches can be operated by means of chain gear from the switchboard *a*.

(*c*) The third part is situated behind the switchboard *a* and on a floor on the same height with the balcony. This part contains the 26,000-volt switches and fuses, and, generally speaking, all the apparatus carrying the voltage of the transmission line.

The main switchboard, *a*, is composed of 11 panels, each of which

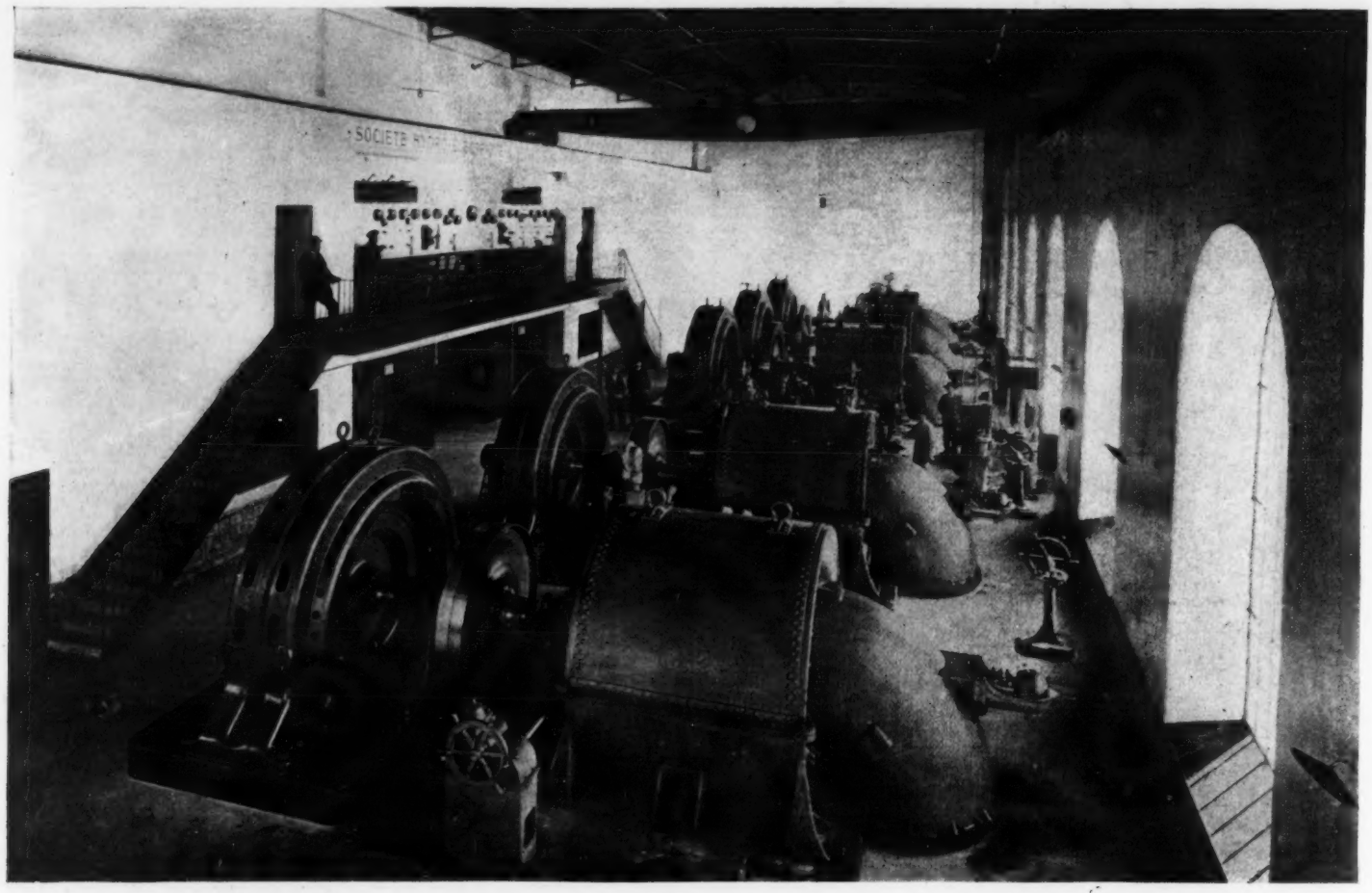


FIG. 3.—VIEW OF INTERIOR OF MAIN GENERATOR ROOM, GRENOBLE.

1,150 kv-amp capacity each and their total height is about 8 ft. 4 in. The weight of one transformer including oil is about 9 tons.

These transformers have been so arranged that by a simple change of connection, which can be effected at the switchboard, the ratio of transformation can be made to be at will either 3000/15000 or 3000/26000 volts. For this purpose they are provided with three low-tension and six high-tension terminals. The primaries are always connected in triangle; the secondaries are connected in triangle for 15,000 volts or in star for 26,000 volts between line wires. Fig. 4 shows one of the transformers with its oil tank. Fig. 5 gives a view of the interior of the transformer house.

One of the most delicate points of a high-tension central station lies in the difficulty of assuring an absolutely continuous service and at the same time perfect safety to the persons engaged in the station service. This naturally depends greatly on the kind of insulation used, but more perhaps on the general arrangement adopted for the different connections and switching apparatus. Brown, Boveri & Co. have long been known in Europe for their experience with high-tension work, and the way they have solved this problem in the present case is extremely interesting, as can be seen from the following description of the switchboard.

is set apart for the instruments belonging to either an alternator, an exciter or an outgoing feeder; each panel is, therefore, provided with all the necessary ammeters, voltmeters, phase indicators and switches. Besides this, a central panel contains a totalizing voltmeter and a handle by which all the field rheostats can be operated simultaneously when coupled together, whilst each one of them can naturally also be operated singly by means of the handle placed on its own panel.

Each alternator panel contains a field switch. In addition, each of the two exciter panels contains one single-pole switch and one automatic minimum-current circuit-breaker destined to work when one exciter is substituted for the other one, thus avoiding a heavy breaking current if one of the exciters were to be cut out too early.

The board consists of an iron framework carrying all the connections and the rheostats for alternators and exciters and covered on its front side with slabs of white marble.

The 3,000-volt switchboard, *b*, carries the six-break main oil switches, the main fuses enclosed in removable porcelain tubes, and the current and tension transformers. This part also consists of an iron framework, which, however, is covered on all sides by wire netting in order to prevent any involuntary contact with parts

carrying dangerous currents. As these nettings are made removable, all the apparatus is easily accessible for inspection and repairs.

The third part of the switchboard, *c*, is composed of nine panels, each corresponding either to a transformer or an outgoing feeder. This part contains the 26,000-volt fuses, separated each one from its neighbor by means of marble slabs in order to prevent a short circuit in case of breaking of one of the porcelain tubes and jumping of the arc formed by the blowing of the fuse. The 26,000-volt

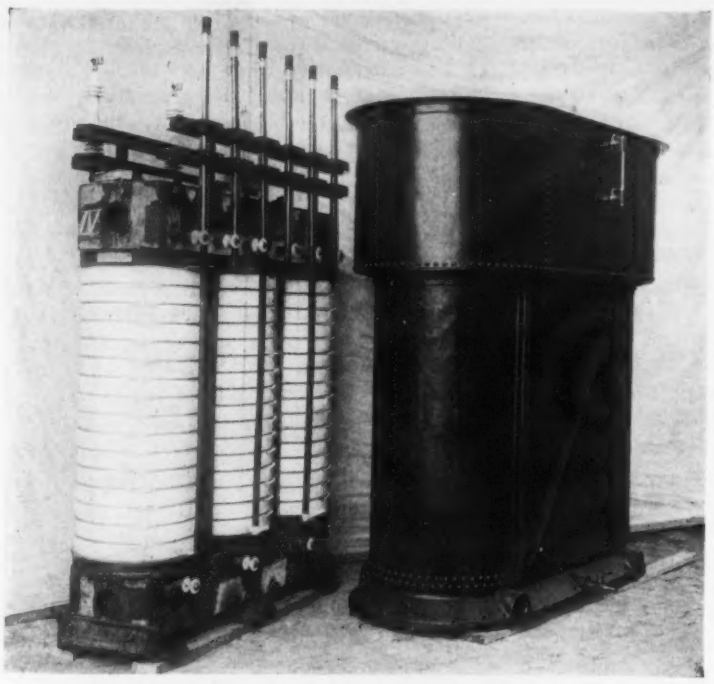


FIG. 4.—TRANSFORMER CORES AND OIL TANK.

switches, also placed on this part of the board, are of the single-pole horn type. They are operated in groups of three, but are supposed to be used only after the main switch of the corresponding alternator has already been opened, i. e., under tension only, the current corresponding to the no-load current of the transformer, and therefore being negligible in quantity. The feeder panels contain also three measuring transformers for the three ammeters.

The totalizing panel contains, besides the measuring transformer for the totalizing voltmeter, an earth indicator by means of which the insulation of the transmission line can be ascertained at any moment, and in case of accident the line found which is grounded. Fig. 3 shows a front view of the switchboard. Figs. 6 and 7 show some of the details of its construction.

Excepting the connections between exciters and switchboards (870 amperes) and the 26,000-volt bus-bars (125 amperes), which are made of bare copper, all the connections between generators and switchboard, between switchboard and transformers, between transformers and 26,000-volt apparatus and from there to the outgoing lines, are made of cables with specially high insulation. They are supported in the galleries left in the basement by means of special insulators fixed to iron framework. The arrangement is such that inspection of all parts is easy and can take place without any danger at any moment.

Six holes are left in the wall of the building and fitted with earthenware tubes of a large diameter, erected with an inclination towards the outside. Concentric with these tubes are glass tubes of smaller diameter carried by the outgoing insulated wire itself and intended especially to prevent deterioration of the insulation at this exposed point.

Before leaving the building each line passes a lightning arrester which is of the single-pole horn type in connection with a water resistance and a fuse. As these lightning arresters are designed to work at 26,000 volts, the distance between the two horns is fixed at about 10 inches and the three arresters are so connected together that the current following an atmospheric discharge will have to traverse two such air gaps on its way from one line to the other besides encountering earth between the two gaps.

As a supplementary means of safety, auxiliary lightning arresters of the Wurts type are placed between each transformer and generator on the 3,000-volt circuit in order to protect more efficiently the alternators in case of an accident happening to the main lightning arresters.

A very complete set of tests has been made on these machines, first in the shops of Brown, Boveri & Co., and once more after their erection. We give below the figures obtained during the official tests made at the central station by the engineers of the Fure et Morge Company:

(1) Alternators of 1,350 hp each, 3,000 volts, 300 r.p.m., 50 cycles per second.

Efficiency at full load	($cos\ \phi = 1$)	180 amp.....	94.5%
" " " "	($cos\ \phi = 0.8$)	223 amp.....	93.8%
" "half "	($cos\ \phi = 0.8$)	113 amp.....	90.8%

The temperature rise after a continuous run of 6 hours at full load was found to be only 35° C.

The difference in potential between no load and full load for power factors varying between 1 and 0.7 was found to be:

For $cos\ \phi = 1$	4.7%
For $cos\ \phi = 0.8$.....	13 %
For $cos\ \phi = 0.7$.....	15 %

The insulation was tested by applying 6,000 volts alternating current during 10 minutes between the windings and the frame.

Finally, the total load was suddenly taken off of an alternator running at full load, which caused the turbines to run away. Thus a speed of 515 r.p.m. was obtained and maintained for some time without causing any trouble whatever.

(2) Three-phase transformers, three columns in an oil bath with artificial cooling by running water, 1,150 kv-amp each, 3000/26000 volts.

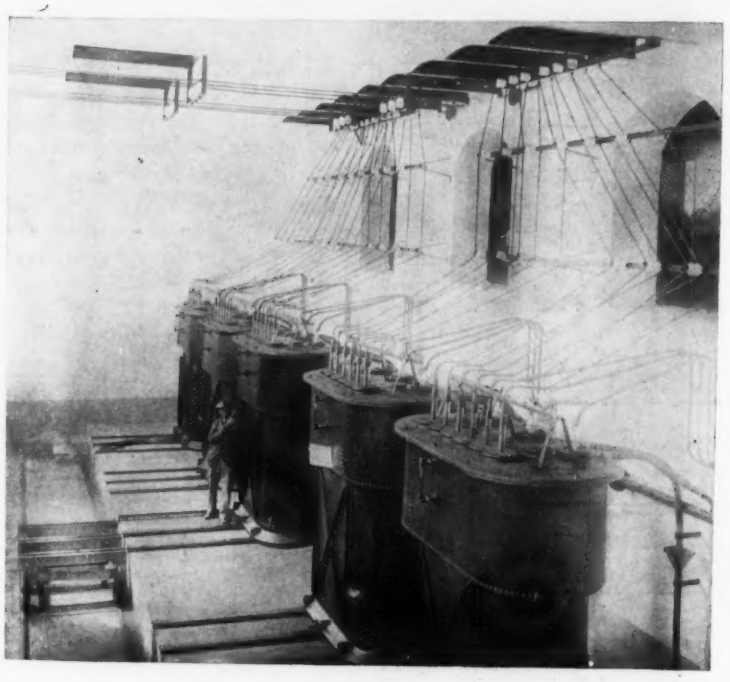


FIG. 5.—INTERIOR OF TRANSFORMER HOUSE.

Efficiency at full load,	925 kw	($cos\ \phi = 0.8$).....	97.8%
" "half "	473 kw	($cos\ \phi = 0.8$).....	97 %
" " ¼ "	236 kw	($cos\ \phi = 0.8$).....	95 %

From the curves taken during the tests at full load it was found that in order to keep the temperature of the oil bath at about 44° C. above that of the surrounding air, a quantity of 6 gallons of water per minute was sufficient, if the temperature of this water was about 5° C. at the entrance and 15° C. at the exit.

The same curves also showed that the transformers could work continuously during 45 hours without any cooling water at all, without any danger of an excessive rise in temperature, provided the temperature of the oil bath was not more than about 12° C. at the start.

The difference in potential between no-load and full load was found to be:

For *cos* $\phi = 1$ 1.0%
For *cos* $\phi = 0.8$..... 4.5%

The insulation of the transformers was tested by applying a pressure of 60,000 volts alternating current between the high-tension windings and the frame and also between high and low tension windings.

(3) Exciters. 100 kw, 115 volts.

Efficiency at full load 92%
" "half " 89%

The greater part of the energy produced by the generators is used in the Département Isère in the industrial region northeast of Grenoble, in the valleys of the Fure and the Morge, the principal centers being Moirans, Voiron, Rives, Charavines, Fures-Tullins.

Moirans is about 22 miles from the central station, Voiron about 4 miles further in the valley of the Morge, Rives about 5 miles west of Moirans in the center of the valley of the Fure about half way between Charavines and Tullins.

The problem was, therefore, to transmit about 3,500 kw to Moirans, about 1,300 kw from there to Voiron and about 1,600 kw. to Rives for further distribution in the valley of the Fure.

Twenty-six thousand volts was adopted for the transmission line, permitting of the use of six copper wires, each of 7 mm diameter, from the central station to Moirans, and three similar wires from there on in each of the two directions mentioned above. The six wires of the line from the power house to Moirans could readily be carried on ordinary wooden poles, but it so happens that this line is exactly parallel to the line of the Société Grenobloise de Force et de Lumière, which company also uses the Drac for power purposes, and the two companies, therefore, agreed to use common supports for their line wires. They chose poles of iron framework carrying at their upper end about 10 yards from the ground three wooden cross arms, the six insulators of one company being fastened to one side, and those of the other to the other side of these cross arms. These poles are placed at about 70 yards apart, and at the place where the line spans the Drac two specially strong poles are placed about 170 yards from one another. The two lines thus go together up to Moirans, where they separate and where the line of the Fure et Morge Society splits up and is carried from there on wooden impregnated poles.

Glass insulators of the Provo type are used and were furnished by the Hemingray Company, of Muncie, Ind. According to the general European custom, they are mounted on iron pins of what is usually called swan neck shape. The insulators have triple petticoats, and each insulator was tested before erection with a pressure of three times normal line voltage.

The fact of having the lines of two different companies on the same poles created the desire to be able to connect the two lines in such a way as to make use of one company's lines for the total load in case of an accident happening to the other line. Special coupling stations have been erected for this purpose at three different points, where a special set of switches allows of any desired connection being made.

According to the size of the customer's motors, a simple transformation from 26,000 volts down to 1,000 volts, or a double transformation from there down to 120 volts is used. The number of transforming stations has been reduced as much as possible, and there

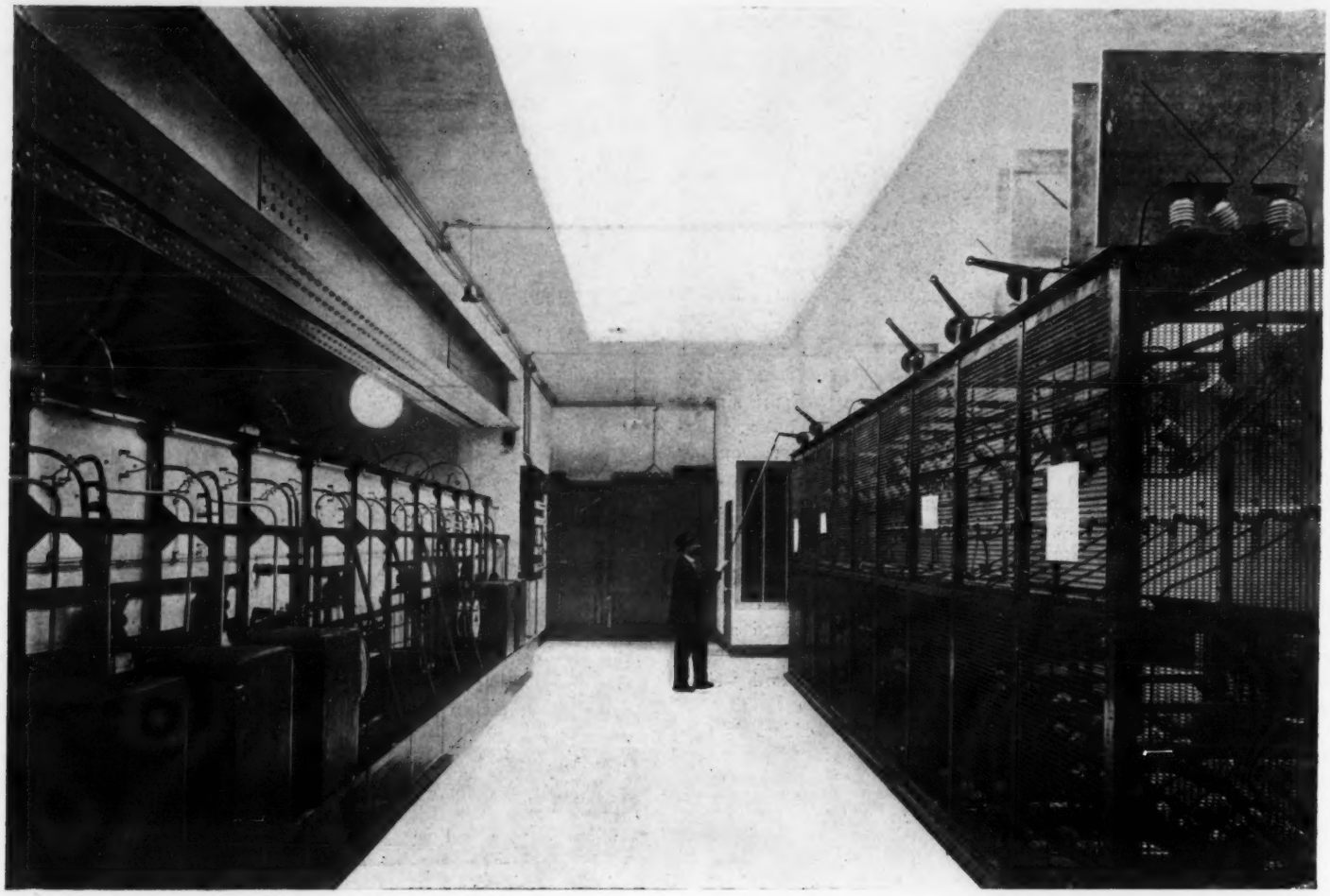


FIG. 6.—VIEW AT REAR OF SWITCHBOARD, SHOWING THE HIGH-TENSION SECTION OF BOARD.

are only three types of transformers in use in order to be able to keep a complete set of reserves for cases of emergency. There are 11 stations with transformers of 500, 300 or 150 kw. The two larger types are designed for artificial water cooling, and are of the same type as the transformers in the central station. The 150-kw transformers are of the ordinary type in an oil bath.

The transformer houses are of masonry work and special windows are provided for getting at the primary and secondary fuses used in connection with these transformers. Lightning arresters are also provided for the incoming and outgoing lines, the high-tension arresters being of the horn type and placed outside on the poles, the low-tension arresters of the Wurts type being placed inside the sub-stations. In addition to this, each station is fitted with a 26,000-volt main switch, permitting of cutting off current from the transformer in case of inspection or repairs.

Besides these primary transformer stations, secondary transformers are used for those motors employing low-tension currents. These

transformers are of the ordinary oil type in sizes of 100, 50 or 30 kw, and are usually placed on the customer's premises somewhere near the motor they are intended to serve. They are usually fitted with a set of primary and secondary fuses only without any lightning arresters.

All of the energy is used for power purposes and the company has not gone in for lighting work at all, as most of the towns traversed by its line have lighting plants of their own. The power is used for a great variety of purposes, the principal use being for the driving of paper mills, silk spinning and weaving mills, cotton and linen spinning and weaving mills, flour mills, mechanical work shops, oil mills, straw hat factories, iron and steel works, etc. Most of these need a very constant speed for driving their machinery, although they are often subject to great and sudden changes in load. The asynchronous motors thus presented a great advantage besides being capable of being handled by men not particularly trained for this class of work. The greater number of these motors are used for driving shafting by means of belts which were formerly driven by steam engines. The sizes of these motors vary between 1 hp and 120 hp.

It is interesting to note the conditions imposed by the Fure et Morge Society on its customers:

(*a*) All motors above 5 hp must have a wound rotor and be provided with a special starting rheostat.

(*b*) These motors shall not use more than normal full load current when starting.

(*c*) The power factor of these motors must be at least 0.85.

The power is rented at the secondary terminals of the transformers

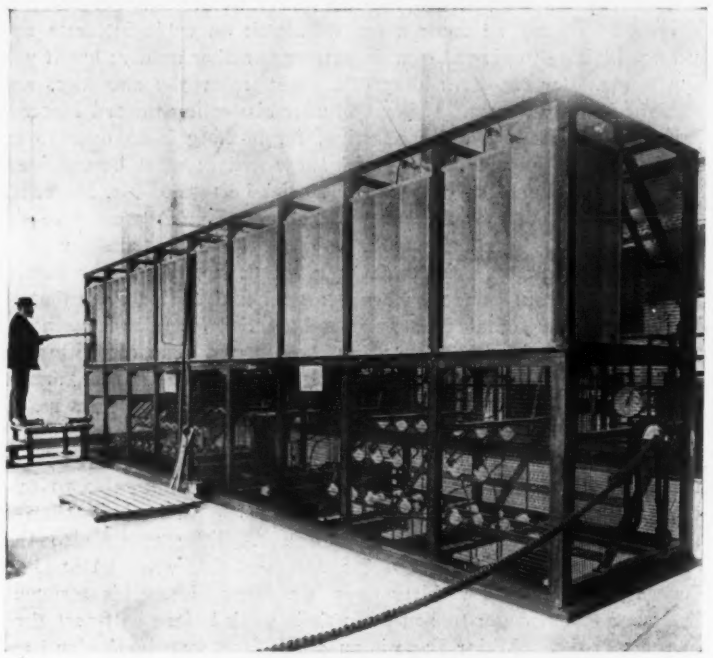


FIG. 7.—A SECTION OF THE SWITCHBOARD.

in electric hp of 736 watts. The main object of the installation was from the beginning the providing of cheap power to the different industries of the region, and a special contract was therefore entered upon by the syndicated manufacturers of the district by which the Fure et Morge Society hands over its complete installation at the end of 30 years to the customers having signed a power contract for this period. Thus the company can count on a fixed yearly income and the prices for the power could be adjusted as follows:

150 francs per hp per year for use during 24 hours per day.

125 francs per hp per year for use during 12 hours per day.

As the cost of the hp per year furnished by steam engines had hitherto been from 200 to 400 francs, it is easily seen that this tariff meant a great reduction of manufacturing costs, and it will certainly go far towards developing further the industry of the region.

The installation was put into regular service March 1, 1902, and since then has been running continuously without incident. This power transmission shows the great development which this art has of late undergone in Europe, and though higher voltages have been successfully employed in the western part of the United States, yet the voltage used by the Fure et Morge Society is the highest used so far in Europe.

A Notable Marconi Celebration in New York.

JUST a year ago the American Institute of Electrical Engineers celebrated Mr. Marconi's great achievement in "jumping" the letter "S" across the Atlantic by giving him a dinner at the Waldorf-Astoria that will long be remembered by all who were there. In the interval Mr. Marconi, with wonted patience and persistence, has been teaching the ether how to spell all the other letters in the alphabet, and has, like his great Italian forerunners, Cæsar and Columbus, now taken out a fee simple to the biggest space open to the conquest of his genius. After threading the ether with thought, and performing before all the crowned heads of Europe, Mr. Marconi has reached New York, and last week did equal honor to a number of its residents by dining with them at the Metropolitan Club, on the invitation of the directors of the Marconi Wireless Telegraph Company. For those who thus heard in plain and direct description from the lips of the brilliant young inventor last Saturday night, the story of his recent immortal achievements, it will indeed be an ever memorable evening. The party was not particularly large—some fifty strong—but the hosts had brought together a body of men well known and representative in all their respective fields of endeavor and success, including Sir Percy Sanderson, British Consul; Signor Branchi, Italian Consul-General; Dr. M. I. Pupin and Dr. F. B. Crocker, from Columbia University; bankers and financiers like D. O. Mills, Spencer Trask, J. J. McCook, E. R. Morse, C. S. Sedgwick, G. R. Sheldon, R. Goodbody; George G. Ward, vice-president of the Commercial Cable Company; C. A. Coffin, Gen. Eugene Griffin and E. W. Rice, of the General Electric Company; legal lights like Eugene Lewis, John Bottomley, F. H. Betts; prominent journalists like C. R. Miller, Chester R. Lord; S. S. McClure, H. H. McClure, Lt.-Comr. J. D. J. Kelley, Ralph Pulitzer. Are was represented by men like A. F. Jaccaci and Dr. F. B. Herzog, of the National Arts Club; commerce by Gustav H. Schwab; the church by Rev. Dr. Burrell; wireless telegraph interests and staff by W. W. Bradfield, W. R. Betts, J. D. Oppe and W. H. Bentley. The electrical press was represented by S. H. Goddard and by T. C. Martin, of ELECTRICAL WORLD AND ENGINEER. One of the jolliest and most democratic of the party was that active member of the British nobility, the versatile Duke of Newcastle. The decorations of the rooms and the big oval table were most profuse and in admirable taste, due in no small measure to the arrangement of Mr. Eugene Lewis; American and Italian flags being blended everywhere as well as on the beautiful menu. It is a rather curious and amusing fact, indicative of the wide range of interest in what is going forward in this work on the very edge of the intangible and impalpable, that the portrait used of Mr. Marconi on the menu, as most faithful, was reproduced from a Christian Science publication. It showed him, however, with a trim mustache, whereas his face on Saturday was entirely without beard, bringing out its fine lines, but emphasizing its youthfulness in a very marked manner. It should be noted that the ice cream favors consisted of chocolate confections shaped like the later four-square quadrangle of Marconi towers—highly suggestive of the oil and gas wells from which other wealth has been tapped.

Attorney General Griggs, who is connected with the company, acted as toastmaster, and immediately played a strong hand of royalties in proposing the health of the three sovereigns who had helped Mr. Marconi in his work—President Roosevelt, the King of England and the King of Italy. He mentioned naively the fact that when a boy he had learned the Seven Wonders of the World, but that having forgotten them he found excellent substitutes in modern scientific discovery, and especially in the great results attained by their guest of honor. This neat and happy introduction brought Mr. Marconi to his feet to describe with wonted modesty and forceful effect what he had been doing of late. Unfortunately, though with due regard to club proprieties, what happens at the Metropolitan is done "under the rose," so that a passing summary must suffice of this address and of the oratory in general. He said in effect: "The difference between the work of starting the cable system and that we have to do in wireless telegraphy is very great. One-half of the machine in the wireless system is on this side of the Atlantic and the other half on the other side. During much of the time we have not been able to communicate by cable messages from our stations. We cannot send all our instructions from one station to the other by cable. I do not say anything about the cable company, but the land wires over which our messages would have to go run through vil-

lages where they have a mysterious way of letting out one's secrets very readily."

He said that he had been invited to dinners five years ago for sending messages over a distance of two miles, and intimated quietly his hope of earning a few more by improving on his present Atlantic record. In passing, Mr. Marconi took occasion to thank the American daily press for its cordiality towards him and the ready prominence it had given his work. He went so far as to contrast a little bitterly, the difference in the tone of the technical "presses" in England and America, and said it seemed to him that in England they were needlessly hostile and biassed toward what was, after all, irrespective of vested interests, of benefit to mankind in increasing the means of intercommunication. In laying special stress upon the fairness and good will of technical journals in America, Mr. Marconi was good enough to mention by name the editorial staff of Electrical World and Engineer.

"The letter 'S' is a very important letter," he remarked, incidentally. "I don't know but some of the cable companies took it as a signal to sell."

He then spoke of the use of his system by the British Admiralty, which now has sixty warships equipped with it, capable of communicating to distances varying between 75 and 150 miles. "My experiments at Cape Cod and their results," he continued, "justify me in saying that the fact is assured that messages at a high rate of speed and with absolute accuracy can be sent across the Atlantic with no tangible connecting medium except the ether. The fact that stations can be placed on each side of the Atlantic at very slight cost is greatly in our favor. We are under contract with the Canadian government to send messages from Canada to England at an expense not to exceed 10 cents a word. I do not see why that rate should not be a remunerative one to the company."

He said that they will be able to send messages at greater speed than messages can be carried by cable, and that wireless telegraphy does not carry any limitation as to speed or even as to distance, because virtually as the length increased all you had to do was to impress a little more energy on the ether.

Mr. Marconi noted as a happy and significant thing that the President's message, sent from the South Wellfleet station at Cape Cod to King Edward was the very first over the new Anglo-American ether circuit, and went through without a stammer. Here was "Roosevelt luck" again, but it might well be expected that a message from such a source would jump the Atlantic by its own inherent energy. In wireless telegraphy it is "strenuous" that gets there.

Needless to say, the welcome to Mr. Marconi was heartiness itself; and the quiet, cheery amusement with which Cable Manager Ward took the jabs and dabs at the tyranny of the cable kings was in itself a creditable sign that he believed in friendliness toward the new thing, which some day may help constitute a new "combination fixture" in the domain of electrical application. Just at this juncture Mr. Edison came in from the annual dinner of the Automobile Club of America, a fact which in itself testifies to the mental and physical alertness of the veteran. Mr. Tesla has often said to his friends that he didn't think an inventor could do much for his art that was new, after the age of two score or thereabouts; and it is true that electricity calls all the time for new men. A young lady in New York society was being urged recently by her father to marry a well known public man of fifty. She replied that she appreciated the honor, but she would much prefer two at twenty-five. Electricity is somewhat in the same attitude toward those who woo her. But those who were at the dinner last Saturday and saw the "grand old man's" alacrity, good humor and keen enjoyment of it all, must have felt he was still in the twenty-five class, even if he could not find a solitary word of acknowledgement to the toast in his honor.

Governor Griggs then invited Dr. Pupin to tell Mr. Marconi how he did it all, and if Mr. M. is still uninstructed it is not the good Doctor's fault. After Dr. Pupin got through no one believed the theory he advanced that a man's ability as an inventor is inversely proportional to his gift of eloquence. No one in this country has a better right to discourse on the subtle and esoteric ideas underlying etheric phenomena, and it was brilliantly, magnificently done. Everybody felt, indeed, that they were taking a four-year post-graduate course in the lower mathematics of the higher physics. The best part of it all was the analogy drawn by Dr. Pupin between physiological or psychological nerve conditions and those embodied in both submarine cables and wireless systems. It was a charming presentation of the scheme of Providence, and Dr. Burrell gathered in copious ideas for subsequent Sundays. One was reminded, indeed, of the story told of Lord Palmerston when at a reception he was buttonholed and cornered by Sir Charles Wheatstone with a very long account of the way in which the telegraph worked. The genial prime minister had other duties, and seeing the head of the English church advancing he exclaimed: "Why, here is the Archbishop of Canterbury. Just tell all that to him. He will be delighted to work it into his next pastoral"; and with that he fled. They say that Dr. Pupin is so busy over the great inventions that are adding such lustre to his own name that he does not have time to prepare any lectures for his classes in Columbia. This must be seriously doubted by those at the Marconi dinner, for he certainly was ready for every scheduled hour of the current week at the University. Incidentally it was a pleasant comment on the catholicity of American life to see Pupin and Marconi side by side, these two fine modern spirits from far-away antique corners in Southern Europe, and to recall the splendid warmth of the reception that has been given them and their inventions on American soil. Equally gratifying was it to hear from Dr. Pupin, the whole-souled praise and defence of Marconi—by one who has the fullest right to express a weighty opinion. Likewise, it did one good to hear from him the well-deserved and suggestive reference to the possibilities involved in the pioneer work now being done by Peter Cooper Hewitt.

Gen. J. J. McCook made a brief but most charming speech, in one movement, full of poetic feeling, but animated with swift and felicitous references to Arago, Faraday, Morse and Henry; and applying to Marconi the simile of Emerson, that he had indeed "hitched his wagon to a star."

Then came Major Flood-Page on behalf of the English Marconi interests. To say he made a frontal attack on cable interests and did not hesitate to give affront, is putting it rather mildly; but it was a genuine, sterling British speech, right from the shoulder, and straight from the heart. It is no wonder his feeling toward Marconi has become one of evident affection, for nothing is so dear to an Englishman as pluck, courage and sheer grit in what he considers a worthy and righteous cause. The stories he told of Mr. Marconi's early efforts were fascinating to a degree and elicited some of the warmest applause of the evening. As one listened to the story of an interview held in the grim dawn of a winter morning at the austere Euston Station, in London, when Marconi told Major Page that he knew he could signal from England to Newfoundland, with the aid of either kites or balloons; and then started right off with their blessing for that bleak and icebound bluff, one could not but marvel how the English ever came to be thought slow and conservative. It is backing such enterprises with all she has that has put England where she is; and it was simply glorious to note in the Major's remarks the personal illustration of the English willingness to take every risk for a profound conviction, not less in business than in the political upbuilding of an empire. A little touch also that "brought down the house" was his statement that when up at Glace Bay he found that for thirty days Mr. Marconi and his assistants had none of them got to bed from their work before half-past three in the morning. Major Page is an old Edison man in England and the incident recalled painful episodes to some of Mr. Edison's associates, who, in the old days when the volcano of invention at Menlo Park was in full eruption, had not known what it was to go to bed for seventy-two hours at a stretch.

And so this memorable banquet came to its close, with a practical finale in an exhibit of Marconi apparatus set up in the two corners of the room, and over which in good old telegraphic style, Marconi sent Edison his "Seventy-Three."

Electricity at the World's Fair.

The Department of Mechanical and Electrical Engineering, at the St. Louis Fair is wiring the Education Building, formerly the Textiles Building. The wires are so carefully concealed that cursory inspection fails to find them. Chief Engineer Rustin has devised an attractive scheme of night decoration for this building. The upper and lower cornice lines of the building will be marked by 8-cp incandescent lights, 10 in. apart. The vertical lines of the corner pavilions are marked in the same way. The rest of the facade, which consists of a magnificent sweep of giant fluted columns, will be treated so that the columns will be silhouetted against the screen wall, which will be a blinding blaze of white light. This unique effect will be obtained by inserting in the rear fluting of the column a line of electric lamps, invisible from the front of the building.

Telephone Meeting of the American Institute of Electrical Engineers.

A VERY crowded and successful monthly meeting of the American Institute of Electrical Engineers was held in New York City at the house of the Mechanical Engineers, when once again the difficulty of accommodating and seating so large an audience in the present quarters was illustrated. As a general thing telephony is not supposed to have much attraction for an Institute gathering, but on Friday night last, January 23, the place was filled to suffocation, and the quality of the attendance was also strikingly high.

President Scott introduced the subject of the evening in an admirable address. He pointed out that telephony is not merely an invention, but that its great system of conductors and connections are more properly the work of the engineer, supplemented again by that of the mechanical designer. "The telephone switchboard," he said, "has not sprung into existence fully equipped for its requirements. It has been an evolution. The requirements themselves have been an evolution; an evolution in a field quite apart from that in which dynamos and motors and electric lighting and power transmission have held sway. The telephone evolution may have attracted less attention; it has been less heralded, and the details and methods less generally known; but the apparatus and methods used in the modern telephone system have not come as the result of inspiration or luck, but they have followed along the lines of scientific evolution. The advance has been by step, but the steps have followed rapidly, and in a score of years a system has been evolved almost perfect in its operation, of colossal extent and marvellous in detail. It has brought about in these few years changes in our social and commercial methods greater than have occurred throughout centuries in the past." Mr. Scott then introduced Mr. Thomas D. Lockwood, to whom he paid a deserved compliment as one who had been prominent in telephonic development for many years past.

Mr. Lockwood then presented a paper of some 27 pages in which he discussed in a masterly manner the evolution of the telephone switchboard. After discussing the earlier stages of the work and the importance of a good "busy test," he said:

"The subsequent development of the telephone switchboard depended upon the outcome of three apparently parallel and independent but really co-ordinate and gradually convergent lines of investigation, which were all about this time under consideration. These investigations were directed towards:

"(*a*) The further improvement of the switchboard apparatus proper, by abolishing the serially-connected jack contacts, which as indicated, were a prolific cause of imperfect service; and by substituting some form of construction wherein each subscriber's line when switched to another, would have a clear, continuous and highly conductive path through the switchboard for the voice currents; together with such other changes as each progressive advance might render necessary.

"(*b*) To do away, if possible, with the multitudinous transmitter batteries of the sub-station and operating room, and to substitute for them a common central source of transmitter current; for if this could be done, there would not only be effected a great reduction in the number of cells required, but such as were required might be kept at all times under the eye of skilled employees.

"(*c*) To arrange if possible for the gradual displacement of the sub-station call generator, and the necessity for its operation in the transmission of incoming call signals; to provide that call and disconnect signals should be automatically transmitted by the simple acts of taking the receiver from the hook switch, and restoring it thereto; and to devise suitable appliances at the central station for the appropriate display of these signals.

"These several directions of prospective advance seem superficially to have little necessary community with each other, but the closer they are viewed, the more apparent will it appear that the realization of all would inevitably involve the complete re-organization of the switchboard; and that the efforts thus far devoted to the subject must be regarded henceforth as having resulted mainly in the determination of the principles which should be followed; and of what features were and were not desirable in an ideal switchboard. This was a well-advanced position; and constituted a definitive foundation on which the completely organized superstructure of an efficient modern switchboard might be successfully reared."

Mr. Lockwood pointed out that the connection of multiple board jacks in parallel was not at that time a new idea; and he then outlined the steps by which "the 'how' of an efficient central and common battery system for telephone circuits and the central and sub-station transmitters, together with a system of incoming call signals and supervisory signals was as a whole devised and decided upon." His paper thereupon took up and illustrated in some respects the details of modern operation.

Mr. Lockwood concluded his excellent paper by saying: "It is, however, obvious that to realize this conservation and economization of time to the fullest extent, the possibilities of usefulness inherent in the telephone itself must be competently seconded by a central station switchboard through which all of the several operations and sub-operations requisite for the connection and disconnection of lines, can be carried out with accuracy and celerity. The standard relay switchboard—as the organization of apparatus and circuits whose development I have traced has been entitled—is such an instrumentality; and by it, notwithstanding the marvellous increase of late years in the number of lines entering large central stations, and in the number of calls received and connections made in pursuance of such calls, the speed and efficiency of operation has been not only well maintained, but has exhibited marked improvement.

"Here, then, at least for the present, we take leave of our theme. The efforts expended in producing the switchboard which for the time is standard, are amply justified by the general satisfactoriness of its work. True, its organization is complex, but so is that of every poly-functional machine; and why should we object to complexity if accompanied by corresponding efficiency; or unless it shall be proved that the same efficiency can be achieved by simpler means. This switchboard, though not yet a perfect product of evolution, is at least a complete and successful machine; but evolution still goes on. It may well be that the next step in its never-ceasing progress will be in the direction of simplifying the organization either in its concrete devices or in its circuit arrangements, without any sacrifice of efficiency."

Mr. John J. Carty, in calling attention to the fact that the inventor of the telephone was a member and past president of the Institute—Prof. A. G. Bell—mentioned also the name of Mr. Edison in the same connection. He said that Mr. Lockwood had given them the successes of the switchboard, but had touched very lightly on the failures. He alluded to Mr. Lockwood's official capacity of tea taster for his company, and characterized him as a lord high executioner, whose hands were red with the blood of inventions. Mr. Carty made the following statement of interest: "After looking over our statistics for the hundred thousand instruments in Manhattan, and looking at the trouble records, I find that using the system described the telephone station in New York is out of order for a period of one hour and twenty-seven minutes on an average during a given year. That means that on the average every station will be in good order during the entire year except for a period of one hour and twenty-seven minutes. These figures are taken directly from accurate records and speak volumes in favor of the new type of switchboard which Mr. Lockwood has so ably described; this absence of trouble being one of the principal features of the success which has accompanied the installation of the switchboard."

Mr. F. A. Pickernell remarked: "A switchboard engineer, if he designed a defective apparatus, might introduce losses in the service and impair the service to an extent which could not be counterbalanced by tons of copper in the circuit. Some of these electric magnets in service which Mr. Lockwood referred to might not only impair the transmission, but they might introduce sources of disturbance due to an unbalanced condition. All these things had to be taken up in designing this equipment. The effort has been made and successfully carried out to arrange the apparatus so that any particular station may be connected with any other particular station, within the range of a thousand miles, and the switchboard engineers have designed their apparatus so well that from the telephone station located in this building connection can probably be had with three-quarters of a million, if not a million, other stations in various parts of the country. None of these results could have been produced or attained if the switchboard work had not been of the highest possible type."

Mr. B. Gherardi, Jr., chief engineer of the New York & New Jersey Telephone Company, made an elaborate contrast between the functions of an electric light station and those of a telephone

exchange; and Mr. E. F. Sherwood, of the New York Telephone Company, took up a few questions of traffic. He said:

"The first standard relay switchboard installed in New York was cut into service on November 13th, 1898, and the last one, which for Manhattan Island rounded out the conversion of the entire system of local switchboards to a relay basis, was cut into service November 2, 1901. The tests of service for the year preceding the installation of the first relay switchboard in New York and for the year 1902 show the following results:

	Avg. time taken by operator to answer.	Avg. time taken to complete local connections.	Avg. time taken to complete trunk connections.	Avg. time taken to disconnect.
1897.	7.7	27.6	50.7	17.1
1902.	3.8	23.7	30.7	2.8

"The improvement made in the time of answering is chiefly due to two causes: First, unlike the arrangement of magneto equipment, the answering jacks in the relay board are immediately associated with the line lamps or calling signals, so that no time is lost by the operator in locating the answering jack corresponding with the calling signal; and second, with relay equipment subscribers' lines are promptly released after conversations are finished, and delays due to slow clearing out of previous connections do not occur as they did with magneto equipment, which required that operators should listen in and ask "Are you through?" in every case before disconnecting.

"Further evidence that the installation of relay switchboards has improved the service is furnished by the record of written complaints from subscribers. During the year 1897, when the average number of subscribers' lines in service in Manhattan was 17,066, a daily average of 3.2 written complaints were received, or one complaint a day for every 5,333 lines. During the year 1902, when the average number of subscribers' lines in service in Manhattan was 49,955, a daily average of 3.3 written complaints were received, or only one complaint a day for every 15,138 lines; or to put it another way, at the rate of one complaint for each line every 41 years.

"The relay switchboards in New York have been put to the most severe test, and have stood that test in a most satisfactory manner. Since the installation of the first relay board in New York, the number of lines in Manhattan has increased from 20,740 to 53,792, and the number of stations in Manhattan has increased from 25,516 to 91,945. During this time the daily average number of calls originated by subscribers has increased from 243,590 to 549,940, and the daily average number of connections handled by each subscriber operator has been increased from 750 to 1,070; and yet with this very large increase in lines, stations and traffic, and the material increase in the number of calls handled by each operator, the relay switchboards have enabled us to make a very substantial improvement in the service." Mr. Sherwood described then the method of instructing new operators.

Mr. G. C. Allen, the superintendent of construction of the New York Telephone Company, then spoke of features of construction. In regard to cables, he remarked: "The early practice of the telephone art was to employ for its cables gutta percha or rubber-covered wires. This was natural enough in view of the fact that telegraph men were, as Mr. Lockwood has pointed out, among the first telephonists, and in telegraph-cable practice rubber and gutta percha, particularly as applied to submarine cables, was then and is still a well-established usage. But in telephony the peculiar effects of capacity were particularly troublesome and drove us to the use of a dielectric having a low inductive capacity. In paper we have found a material which, up to the present time, has proved to be the best to use, notwithstanding its susceptibility to the influences of moisture. The maintenance of such a vast network of paper cables as is required for such a system as that of Manhattan Island is possible only by the exercise of eternal vigilance. The last central office converted from the magneto to the standard type of switchboard was the Cortlandt Street office, which was done a year ago. The work of establishing the new central office involved an additional story on the building, putting in new switchboard and a rearrangement of all cables. Some of the cables had to be handled two and three times, and there were over twenty thousand to be handled and reterminated in the new terminal room and connected to the switchboard. When the switchboard went into service on Monday morning—we generally do work of this character on Sunday—it was found that five or six of the circuits were misplaced and that connections on ten or twelve had not been properly made. These troubles were remedied, and the rest of the subscribers did not realize a change had been made in the system. At the present time on Manhattan Island there are installed as part of the telephone system, outside of the company's offices, 222,543 miles of telephone conductors. Of this vast mileage of wire, 98.08 per cent. is wholly underground. Substantially all of these wires are paper insulated and covered with lead pipes."

Mr. W. J. Hammer then read an elaborate paper on the Faller automatic system, which has already been very fully illustrated and described in these pages. It embodied an elaborate summary of the various features of advantage and disadvantage as between the manual and the automatic method of operating exchanges.

Mr. Lockwood said: "Mr. Gherardi's remark about the necessity for co-ordinating the stations in large cities, for example cities like New York and Boston, was highly interesting. That is a remarkable thing, but it is not a matter which is reached in a moment; and the necessity for co-ordination was not apparent until after the long-distance telephone rendered commercial service and rendered it well. I also was much instructed and interested in his statement which I perhaps may paraphrase, that the telephone engineer has to be more kinds of an electrical engineer than perhaps any other electrical engineer following a specialty. That may sound paradoxical and sophistical, but it is true, and I have been accustomed to congratulate young telephone engineers on the fact that having to deal with the weakest current which is employed in commercial work, they must also be prepared to deal with all other currents.

"Of course, neither I nor any one else at this hour of the evening could seriously think of making any discussion on the paper which Mr. Hammer brought before us, but I think all of you will agree with me that there is certainly one advantage in the mechanical operator of which he spoke—there will not be 700 resignations in a year of operators who desire to get married. (Laughter.) I think that advantage in one sense is a great deal. The mechanical operator has that advantage over a human operator, as I cannot imagine any subscriber in any possible contingency wanting to marry one of his mechanical operators." (Laughter.)

Mr. F. E. Kinsman: "Mr. Lockwood omitted reference to the first telephone exchange established in Boston. He said, if I recall, that it was a connection made by twisting a wire from one post to another. As a matter of fact, I was employed in Boston in August, 1877, and my recollection is that the first exchange was operated by transmitting the message through the operator.

Mr. Lockwood: "There is a brief reply needed to the last remark. The first exchange was established in Boston in May, 1877, through some burglar alarm wire."

Mr. Kinsman: "I will take the correction as to date; but I will say that the exchange was first introduced in Mr. Holmes's burglar alarm office, and it was made by the operator taking the message and turning about and talking through the telephone to the party to whom the message was to be given."

The meeting then adjourned.

Institute Annual Dinner.

The annual dinner of the American Institute of Electrical Engineers will be held at Sherry's, New York City, on Monday, February 9, and will be specifically a "Library" dinner, just as the brilliant affair of last year was a Marconi dinner. The presidency of Mr. Scott has witnessed a wonderful growth in the new library, based on the gift of the Latimer Clark collection by Dr. S. S. Wheeler and seconded by the generous gift of Mr. Andrew Carnegie, who duplicated in a money donation for general purposes the value of the Wheeler gift. Mr. Carnegie is to be the guest of honor upon this interesting occasion before his departure for the South, so that the members will have an opportunity of expressing directly to him their gratitude for his liberality and encouragement. The list of speakers will not be long, but will include some very well-known men, and will have throughout a literary flavor. The dinner is to be attended by ladies as well as gentlemen, and the dinner committee believes there will be an attendance in excess even of that enjoyed in 1902. Tickets will be $5 per cover, without wine, which will be served á la carte, and orders should be sent in at once to the secretary, at 95 Liberty Street. Only orders accompanied by check will receive attention. A novel and attractive menu design worthy of careful preservation has been prepared for the affair.

The Metric System and Export Trade.

Deputy Consul-General Dean B. Mason, of Berlin, Germany, in reporting to the State Department on "Metric Weights and Measures in Germany," says that an American commission agent residing at Berlin, who is constantly bringing American and German business men into connection with one another, and who is quite intimately acquainted with the import and export trade between the two countries, considers that the use of the awkward system at present employed in the United States is a very decided inconvenience and hindrance to trade between the two countries. He cited various instances where injury had been caused, and among others the misfortune of an American who had his goods seized at the German custom house and was involved in a lawsuit with the government, owing to a blunder caused by the use of the two systems. A Hamburg commission agent and a German citizen stated that he was firmly convinced that the use of different weights and measures in the two countries caused inconveniences that made themselves seriously felt in every export and commission house dealing in American goods; that the conversion into decimal units caused serious loss of time; that the system of bookkeeping in use in Germany could not be applied to American goods.

The report indicates that German houses which have adjusted their methods to the American system will not view with favor a change, since it would be likely to subject them to more general competition in the American trade. With firms buying only occasionally from America, however, the inconvenience of two systems is keenly felt. American firms unacquainted with exigencies of foreign trade and seeking to obtain connections or business abroad continue to send circulars in the English language, in which our weights and measures are used, the result being that they generally find their way to the waste paper basket without serious consideration. A consular officer has not infrequent opportunity to observe difficulties created by ignorance of the metric system on the part of Americans, who are placed at a disadvantage owing to their ignorance on this subject. Particularly in the export of machinery, in which complicated specifications are often requisite, the difficulties caused by the use of the two systems are especially apparent.

The German law adopting the metric system was promulgated August 17, 1868, and made the use of the system permissible after January 1, 1870, and obligatory after January 1, 1872. According to testimony obtained at the Berlin Chamber of Commerce and through other reliable sources of information, the general use of the metric system in wholesale business was introduced promptly without serious inconvenience or opposition and with very satisfactory results. In retail trade some of the old weights and measures are still in use, after having been modified in order to correspond with the metric system, the old names being still retained. The German pound, for instance, is exactly one-half a kilogram, and many articles are sold at retail by the pound, half pound, etc. Professor Fischer, who was in charge of the German Bureau of Weights and Measures at the time the metric system was adopted, and is probably better qualified to judge of the difficulties encountered in its introduction into Germany than anyone else, stated in a personal interview that no serious or concerted popular opposition to the innovation was encountered, and that owing to the period of time after the law was published before the metric system became obligatory, the public was well supplied with metric weights and measures and more or less familiar with their use. Professor Fischer is fully convinced as to the great benefit derived by the German nation from the change. As to the expense involved by the change, it is impossible to derive any very definite conclusion from the statistics and reports of the German government. Information was asked on this point both by the American and English governments some time ago, together with data, as to the difficulties and results of the introduction of the metric system into Germany, but a careful examination of the reports made by the German authorities failed to give any definite information on this point. Owing to the different economic conditions that prevailed in Germany thirty years ago, such information as could be obtained relative to the expense entailed by the introduction of the metric system would necessarily be of very limited value.

While German experience as to the difficulties incident to the introduction of the decimal system may be of limited value, there can be no question as to the great advantage derived from the change. On this point, public opinion is practically unanimous; whether it be the experts of the Bureau of Weights and Measures, business men, or manufacturers, only one opinion has been found, and when the radical advantages of the metric system over the weights and measures formerly in use are considered, this unanimity is almost a matter of course. It is only those who have used the metric system after having been accustomed to the use of other weights and measures who can realize fully its great superiority when calculating or computing. The only example of the advantages of the decimal system for purposes of calculation over other systems that can be readily observed by the American public is the far greater ease and rapidity with which it is possible to calculate in dollars and cents than in pounds, shillings and pence. While, owing to the great number of semi-independent states in Germany, the need of a single authorized system of weights and measures was still more imperative than in the United States, the advantages to be derived in America by the adoption of the metric system are practically the same as have already been attained in this country. Owing to its scientific character and greater simplicity, the German citizen has a far more complete comprehension of the weights and measures of his country than the American. He saves a great deal of time and labor both at school and in later life and numerous possibilities of error are avoided. Considering the inherent advantages of the metric system and the experience of Germany and other countries where it has been introduced, it is safe to predict that if it ever comes into general use in the United States there will be the same unanimous verdict both as to its satisfactory character and the wisdom of its adoption that is given in Germany to-day.

The metric system has spread with ever-increasing rapidity throughout the civilized world. It has been adopted by the European states, with the exception of England and Russia, and by most of the South American states, by Mexico, and even by Turkey and Egypt. Unless the American people are willing to see the civilized nations using one universal system of weights and measures and the United States and the more backward countries like China adhering to their old and clumsy weights and measures, it is likely the metric system will have to be adopted. Both in England and Russia the sentiment in favor of the metric system seems to be growing steadily, and it is likely that it may be adopted in these countries within the near future. It is probable that the agitation in favor of the adoption of the metric system in the United States will continue and that if it is not introduced now, it may be introduced later on when the change would involve far greater expense and inconvenience. With the population increasing 20 per cent. every ten years and a rapidly expanding industrial development, it is important that the metric system, if it be adopted at all, should be accepted as promptly as possible.

In considering the question of the adoption of the metric system in the United States, the one valid objection that can be raised is the difficulty of the change. Owing to different political and industrial conditions, the experience of European countries is of limited value to the United States; but their experience tends to show that the radical measure of rendering the metric system permissible for a certain period, after which it becomes the only system that is legal, is an effectual way of bringing it promptly into general use, and is far more economical and satisfactory than halfway measures. The experience of Germany also shows that an efficient bureau of weights and measures is one of the most potent and necessary factors in making such a change.

While the general introduction of the metric system into the United States will undoubtedly cause temporary expense and trouble, the benefits derived from its adoption will be permanent, and a far greater population than that of the United States at present will be materially benefited by the change.

Trusts in Germany.

Discussing the subject of trusts, the *New York Times*, in a recent issue said: Those who fancy that the trust is peculiarly an American institution, the mushroom product of prosperity, may be comforted to know that Germany has more than four hundred well-developed trusts, and that at last accounts they were multiplying rapidly. The greatest number of them in any one industry have been formed in the several branches of chemical manufacture. There are several in the electrical industries, and it is announced that these are about to be united in the Central European Electrical Trust, which is to control everything worth controlling.

Proceedings of the Northwestern Electrical Association Convention at Milwaukee.

THE regular annual meeting of the Northwestern Electrical Association was held as usual at Hotel Pfister, Milwaukee, Wisconsin, January 21, 22 and 23, 1903. The convention was called to order at 11:30 A. M., January 21, and President Irving P. Lord, of Waupaca, Wisconsin, read his address, which was in part as follows:

"It is with pleasure that I greet you, at this the tenth annual meeting of the Northwestern Electrical Association. The year just closed has been one of usual prosperity with all industries, and I do not think that the electrical business has been any exception. I can speak somewhat intelligently as to the prosperity of the central station men, as I have talked with a good many of them, and all seem to report a successful year. We find that we have been obliged to pay rather more for our new electrical machinery and supplies than we paid three or four years ago, but even with this pleasant little jolt our increased incomes have been such that our net profits at the close of the year have been somewhat in excess of previous years. Our labor account has also been larger, as it has cost our employees more to live, and necessarily they were entitled to an increase of wages. The merchants and people generally are finding that electricity produces the best light on the market, and while it costs more than other kinds it is worth more. I think that the people are being surely educated to the use of electric lights, and that even in the small cities plants which have in times past had a hard struggle will eventually be placed upon a paying basis, and will return at least a fair rate of interest on the investment.

"One thing that I wish especially to call the attention of central station men to is the tendency of State legislatures to place exorbitant taxes upon electric lighting plants. I do not think that this is really the intention of the members of the Legislature, but there seems to be a large demand from the people in general for increased taxation along certain lines, and especially upon corporate interests. It is probably unfortunate that most electric lighting plants are owned by corporations, for I really think that were the properties owned by individuals they would not be placed in the same classification with railway companies, express companies, street railway companies and the like, against which there now exists a manufactured prejudice. I do not think that there is a man interested in the electric lighting business but is willing that his property should bear an equal and just proportion of the taxes paid by the owners of other property, but the trouble seems to be in determining just what this equitable and fair proportion is. An electric lighting plant can hardly be likened to money in hand, secured notes or mortgages, or even a brick business block or farm, but occupies a field almost by itself. I am in hopes that the legislative committees from the various electrical associations throughout the country may be able to talk this matter of taxation over with the proper committees of the different legislatures, and that it will result in fair and equitable legislation in reference to the taxation of lighting plants. There are already hundreds of thousands of dollars invested in electric lighting plants in the State of Wisconsin, and every year witnesses the installation of new ones and the betterment of old ones. Unless the owners can receive a fair rate of interest upon their investment, progress in this line will be slow."

President Lord then cited a little personal experience in the use of meters. His company began the use of meters early in 1902. Since he put in the meters the load, especially after 11 o'clock P. M., has been reduced fully 60 per cent., and during the earlier part of the evening from 30 per cent. to 40 per cent., while the gross income of the company has been increased about 12½ per cent. He could not too urgently recommend to central station men the benefits that would accrue from the installation of meters or the doing away with the old contract method of selling electric current, so prevalent in smaller cities.

Secretary Thomas R. Mercein then read the secretary and treasurer's report, which included a financial statement and a brief review of the work of the past year. An acknowledgement was made of the debt of the association to Mr. James Wolff, who assumed the duties of secretary in connection with the summer convention at Waupaca, in the absence of Secretary Mercein in Europe.

WEDNESDAY AFTERNOON SESSION.

The first business Wednesday afternoon was the appointment of a nominating committee as follows: John H. Harding, of La Porte, Ind.; E. P. Maxwell, of Dixon, Ill.; H. F. Pearce, of Negaunee, Mich.

On the membership committee the chair appointed H. J. Gille, of St. Paul; O. B. Williams, of Whitewater, and P. H. Korst, of Janesville, Wis.

REPORT OF THE LEGISLATIVE COMMITTEE.

S. B. Livermore, of Winona, Minn., chairman of the Legislative Committee, was unable to be present but sent in a report which was read. This committee is a general committee with sub-committees in each State to look after proposed legislation on central station matters in each State. No legislation of importance was reported as having been enacted in any of the States. A special session of the Minnesota Legislature was held in January and February, 1902. A bill was introduced at this session, which would in effect levy a tax on the face value of the stock and bonds. The bill was defeated. At the present session of the Minnesota Legislature a bill has been introduced authorizing the tax of public service franchises either on the basis of property or gross earnings proportioned among the State, counties and municipalities where the franchise is exercised. There seems to be in Minnesota little objection to a gross earning tax, which a careful study of the matter has convinced Mr. Livermore is the fairest method of taxing public service corporations.

UNIFORMITY OF ADVERTISING.

At the last annual meeting a committee was appointed to report on uniformity of advertising matter. This committee, consisting of H. J. Gille, of St. Paul, chairman; F. J. Bowen, of Kenosha, Wis., and A. M. Barron, of South Bend, Ind., made a report which is given in full, since it is likely to be the beginning of a national movement among electrical interests, toward uniformity of advertising literature.

The primary object of advertising is to bring and keep a class of goods before the buying public. The question is, does the present method accomplish this result; that is, is the advertising matter in such form that it can be utilized for reference by the purchaser, and does the advertiser obtain the best results? There are large sums of money spent annually in advertising matter in journals, through circulars, catalogues, personal canvass, etc., a large portion of which we believe does not bring adequate returns. The reason for this is that it is not distributed in such form that it can be properly filed for reference. In order to keep goods or a concern making or selling them before the buying public it is necessary to have advertising matter in such form that it can be conveniently and accurately filed, and it must be borne in mind that advertising matter is filed by the purchaser, not only on account of advertising a certain brand of goods, but for the information it contains regarding that brand. It would, therefore, seem that the most effective advertising is literature which contains the most information and in such form that it can be utilized for the purpose intended.

The question of uniform advertising is, therefore, a very important matter. If, for illustration, a manufacturer who spends large sums of money annually for the purpose of familiarizing the trade with his goods, could feel that his advertising matter which gives full information covering his goods, was carefully filed away and will be referred to whenever a prospective customer is in the market for that particular class of goods, he would feel that he is getting value received, and would place his customer in a position where he would at all times have complete information covering the product. Such a system of advertising, therefore, would be very valuable to both parties concerned.

This question is not new by any means. It has been considered and discussed by other associations in years gone by. For an illustration, in 1894 the Master Car Builders' Association went so far as to adopt standard sizes for pamphlets, catalogues, specifications, etc., which were as follows: For postal card circulars, 3½ in. x 5½ in. For pamphlets and catalogues, 3½ in. x 6 in., 6 in. x 9 in. and 9 in. x 12 in. For specifications and letter paper 9¼ in. x 10¾ in.

In connection with these standards it was decided that a standard practice should be, to have the proper standard dimensions and the word "standard" printed on the upper left-hand corner of title paper or cover, whenever practicable. These standards, we understand, are still adhered to, and is certainly a step in the right direction. However, we believe that it could be carried considerably further to good advantage.

We also believe that some of the sizes should be changed to

conform to the standard card index system, which is used very extensively at this time, and which was not used so extensively when the Master Car Builders' Association adopted its standards.

We do not know of any electrical society or association that has adopted or has made an attempt to standardize advertising matter, and feel that this association is in a position to adopt standards which we feel will meet with the hearty approval and co-operation of manufacturers and jobbers in the electrical business. We, therefore, recommend that this association adopt standards and suggest the following:

For postal card circulars, quotations, etc., 3 in. x 5 in.; catalogues, 4 in. x 6 in., 6 in. x 9 in. Letter paper, specifications, bulletins, circulars, etc., 8½ in. x 11 in.

All descriptive circulars are to be printed on paper similar in size and thickness to letter paper, and issued in bulletin form; numbered, dated and punched so that they can be bound in a binder. At least two holes to be punched on the left-hand side, 3 in. from the top and bottom, making the holes 5 in. between centers.

For an index to these bulletins we suggest the card index system with which can also be combined prices on material described in the bulletins. On these cards or paper (if cards are used they should be very thin) the index or title subject, to be printed on the top of the broad side with date on the right hand; bulletin number in which description of material can be found, on the left. On the next line to be the manufacturer or jobber's name and address; then following with prices similar to a form presented herewith. These cards to be 3 in. x 5 in. This size could also be used by punching holes on one side to bind in a cover, to be carried in a pocket.

We would also recommend that business cards be of this same size, gotten up in a similar way for filing purposes; for the reason that very often a representative of a company will present his card and if the customer contemplates purchasing any particular article, prices can be put on the card and conveniently filed. This matter has been suggested to several manufacturing and jobbing companies in Chicago and has already been introduced with very good results.

Your committee has taken this question of uniform advertising up with quite a number of manufacturers and jobbers, and are assured by them that they will welcome any suggestion or standard adopted by this association for the reason that it will give them some assurance that the money they are spending for advertising matter is increased in value and is appreciated by their customers, and is in such form that it can be utilized at their convenience.

We think it is not necessary to enter into the question of the form in which advertising matter is circulated at the present time. It is almost impossible to devise a system without considerable labor, that it can be utilized at all. The result is that we venture to say that a large amount of advertising matter finds its way to the waste basket; whereas, if there was a system of uniformity it would be a comparatively easy matter to keep it in some form where it is easily accessible. If the system suggested is adopted each manufacturer and jobber would have at all times a complete up-to-date catalogue of their product or goods in the hands of the customers without going to the great expense of issuing catalogues. H. J. Gille, chairman; F. W. Bowen, A. M. Barron.

Harold Almert, of Chicago, thought the committee's report a good start and that the work ought to be continued and certain matters gone into more in detail. He said the central station men felt very badly the need of uniformity in size in advertising, so that it could be filed according to some definite system.

George Cutter, of Chicago, said that this is an era of filing away information in a manner convenient to be reached; and he, for one, would like to know that his advertising matter and especially that part of it he would arrange for this purpose, would be filed away by the prospective purchaser in such a way that it could easily be found when wanted. Mr. Cutter said that he simply needed a suggestion from a prospective purchaser indicative of what they would like to have in print and what size they wished him to adopt and they could rest assured he would carry out their wishes. He might follow up standard size circulars with some circular of odd shape that the customer might throw into the waste basket if he desired, but which would remind the customer of the other circular that was filed away and still in existence. He did not propose to have his matter filed away and buried.

Mr. Gille: "I have, as you know, taken a great deal of interest in this matter for a long while, and have taken the matter up with various associations, notably the Master Car Builders' Association, who have had this plan in effect since 1894. The purchasing agents of railroad companies, I think, pretty generally, will throw all of their advertising matter into the waste basket that does not conform to standard sizes. It is needless to say here that a central station man will say, unless you do so and so I will throw your advertising matter into the waste basket, for the fact that it has gone on so for years and years makes the statement entirely unnecessary."

T. F. Grover, of Fond du Lac, recited some of his recent trials in locating price lists, which he had filed for future reference and heartily endorsed the movement.

F. W. Bowen, of Kenosha, Wis., said that while he and other central station men had systems which they had used for some time, for filing away information for reference, these systems did not accomplish the object so fully as they would if the association had a standard size for advertising matter which its numbers would receive from manufacturers or dealers. However, he did not think the association ought to act too hastily in adopting sizes, although he was aware of the fact that Mr. Gille had given the matter a great deal of attention for some time.

A. M. Barron, of South Bend, Ind., favored the adoption of the report at once, because any other action would practically sidetrack the matter for another year. He thought if the report were adopted, advertisers would fall in line as soon as its contents became known over the country.

Mr. Cutter thought the scheme should be worked up more fully and the report should not be considered as final. He would like to know, for instance, if he was to adopt any special style of headings on circulars, whether there would be some special classification of machinery, some special method of naming machinery and a number of questions of this sort, a settlement of which would make it possible to file away these things where they could be found.

Mr. Gille: "We have gone into the matter of size very carefully. The first size is United States standard postal card, 3 in. x 5 in.—that is the standard size adopted by the Globe-Wernicke Company and every other cabinet company in the country. Most of us use the card index system to some extent at least, for prices, etc., and we know that to be true. The next size is standard pocket size, a size adopted by every one of you, I think. The next larger is the volume size; that is the standard size in which the proceedings of the American Institute of Electrical Engineers, our own proceedings, the proceedings of the National Electric Light Association, and other associations, are printed. In regard to the letter head size, it is a standard letter paper size, and all patented binders are made that size. We have not favored any one in this matter, and, taking a general view of the matter, the sizes that we have selected cannot be improved on very much."

Further discussion and action on the report was postponed until the following day.

LETTER FROM MR. DOHERTY.

Henry L. Doherty, of Denver, Colo., who was unable to be present, sent a communication, urging that the association take some action tending to support the Louisiana Purchase Exposition, in St. Louis, in 1904. Since the National Electric Light Association has already fixed its place of meeting as St. Louis in 1904, he suggested that the Northwestern Electrical Association hold its summer meeting there, or join with the National Electric Light Association at its convention. The assurance that electrical men would attend the convention will greatly influence the decisions of possible exhibitors and will encourage those who have already decided to exhibit, to elaborate on their present plans. After some discussion it was voted that the association hold its summer meeting in 1904 at St. Louis, in connection with the National Electric Light Association.

NORTHWESTERN ASSOCIATION HISTORY.

Secretary Thomas R. Mercein presented in a very attractive form a brief history of the Northwestern Electrical Association. It was in Oshkosh, in 1892, that a handful of men of electrical interests organized the Northwestern Electric Light Association. The next meeting of these men, with others, was held at Milwaukee, in February, 1893, and the organization incorporated as the Northwestern Electrical Association. Since its first meeting the association has held two conventions annually, except in 1899, when no summer convention was held. The summer conventions were briefly reviewed by Mr. Mercein. The association has now some two hun-

dred members, about equally divided between active and associate lists.

The rapid growth of the electric lighting industry in the West called into a new field of business many bright, progressive men, who had not the technical education now to be had in every college in the land. Manufacturers of electrical machinery turned out a product comparatively in the experimental or development stage. Modern economies of central station management were unknown. Design of central stations was not then, as now, the result of careful, conscientious work by experienced engineers. The ubiquitous legislator, elected often either as a dependable cog-wheel in the political machine, or because he is a "good fellow," and not on account of his brains, ability or judgment, preached municipal ownership as a peg to hang speech upon and as a medium of information for unthoughtful constituents that their representative in legislative halls was protecting their interests.

These and many other reasons led to the formation of the Northwestern Electrical Association, for mutual aid, information and protection, for social intercourse and good fellowship, for interchange of ideas, and standardization of apparatus, material, work and methods. The association has done much to help its members along all these lines.

While the association's proper territory is the Northwest, it has many members in States outside of that region. The association gives special attention to the interests of the smaller central stations in its territory, believing that the larger plants, theoretically, at least, are not so much in need of its services as are the smaller ones. The expense of membership is so light that no plant, however small, is debarred on that account. There has been no special or systematic effort to increase the membership.

After the reading of Mr. Mercein's paper, here abstracted, a vote of thanks was given him and a committee was appointed to act upon the suggestions contained in the paper.

The next paper was by Prof. A. H. Sabin, expert chemist for Edwards, Smith & Co., of New York, on the subject of

METAL PRESERVATION.

The paper, which was somewhat in the nature of an informal talk, reviewed some of his work on the coating of pipe to prevent corrosion, numerous instances being cited where water pipes and the like had been coated so as to successfully resist rust. It was explained why coatings applied cold, as paint, could never equal baked enamel coatings. A high baking temperature of 400° Fahr. during the process of oxidation of the linseed oil which forms part of the compound, prevents the slight porosity of the coating and drives off the film of air, which might exist between the applied compound and the metal to be coated. The fact that this coating, oxidized at a high temperature or in a fused condition, was not porous, was proved in a test made several years ago by an electrician of the General Electric Company, who found a film measuring .0025 inch in thickness to afford complete insulation against a direct current of 6,500 volts. If the coating had been porous it would have allowed the current to leak through the lower voltage.

The process for doing this work requires that the surface of the metal be made first clean, either by pickling or by the sand blast. The sections to be coated are then to be put for a few minutes into the hot oven, then into the hot compound. Two or three minutes is long enough in the dipping tank. It is then slowly drawn out and put into the oven, where it is baked for about two hours, when it is done.

At the close of the paper Mr. Pearce, of Negaunee, Mich., said that central station men had a great deal of trouble with smoke stacks, and inquired the best way of maintaining them.

Prof. Sabin said that the primary trouble with the smoke stack is that it gets so hot that no paint or varnish can be applied that will stand for any length of time, since all these coatings are organic substances. As an engineer, he might maintain that the temperature of the gases going into the smoke stack should be below 400° F., but at the same time this was not always the case, and in consequence the paint burned off the stack. He cited instances where steel stacks had stood five or six years without repainting and the paint was still in excellent condition.

Mr. Pearce said that his greatest trouble was in stacks burning out the fourth or fifth course from the top, the stacks being about 75 feet high.

Prof. Sabin said that this was due to sulphur in the coal, which formed sulphurous acid, which was very, very corrosive. This was not hard on the paint, because good paint would stand considerable acid; but none of the paints was entirely non-porous. The acid gets through the pores to the iron underneath, and heaves the paint off.

J. H. Harding, of La Porte, Ind., inquired as to the efficacy of coating the inside of hot water pipes. He said he was operating a central station heating plant, and had some trouble with the nipples in the radiators being eaten up. There was no trouble with the circulating pipes of the system. He wondered whether there was any preservative that would protect these nipples.

Prof. Sabin did not think there was. He did not know of anything that would withstand hot water for any length of time. Granite ware enamel will withstand hot water for a time, but not for months and years. Hot water will dissolve almost anything, if you give it time.

The president appointed as a committee to consider the relation of national and local organizations, mentioned in Mr. Mercein's paper, the following gentlemen: Thomas R. Mercein, P. H. Korst and E. L. Debell.

A committee was appointed to consider the proposed additional clauses to be inserted in the National Electrical Code, which had been sent for the consideration of the association by the council of the A. I. E. E., regarding precautions to be taken in connection with extra high voltage constant-potential circuits, and grounding of secondary circuits, this committee to report the following day. The committee appointed consisted of W. T. Putnam, R. N. Kimball and P. H. Korst.

THURSDAY MORNING SESSION—TAXES.

The meeting was opened with a call for questions and answers.

Mr. Pearce. "About the only question that I have is the subject of taxes. In Michigan during the last year we have had a tax commission visit all the railroad plants in the State, and our plants have increased in value about 200 per cent. Ours, for instance, has been in operation for about twelve years, and during the twelve years instead of depreciating in value, it has gone up 200 per cent. The plant when it was built cost $142,000, and they had an expert come around and look the thing over, and thought we ought to go down on the rolls for $200,000. We will sell them the plant for $80,000. Now, if anybody has any way to suggest to get out of paying this enormous amount of taxes, which amounts to about 4 per cent. of the capital stock, I should like to hear from them. They have placed our valuation on the basis of the gross receipts of both gas, electric light and street railway, so that if we earn $12,000 our assessed valuation is $200,000. There is another street railway in that part of the State which is a modern, up-to-date plant, recently built. It is one of the best plants in that part of the country. It cost in the neighborhood of a million and a half dollars, and the tax commissioners put it on the list at $577,000. So we have a plant that is a wonder."

Mr. Bowen expressed an opinion that taxation of institutions of this class should be upon a basis of the net results. A plant may cost a million dollars, and lose money; and the additional burden imposed upon it of taxation on the cost of the plant would mean a very considerable deficit in the balance sheet. Another plant might cost a hundred thousand dollars, only one-tenth of what the first plant cost, yet have made possibly 20 per cent. Now that fellow ought to pay an equitable tax, based upon the result of his business. The other fellow has got a non-paying proposition, and, on the theory of the taxing authorities, he really ought to pay no tax whatever. Taxation, in theory, is levied against taxable assets. If the plant is a money loser, it is not going to be a taxable asset for any continued length of time. Taxation of public service corporations ought to be a reasonable tax, based upon their profits, and not upon any arbitrary valuations.

The president thought that it would meet the desire of the public better if these corporations were taxed upon the percentage of their gross receipts, rather than upon their net profits, since the net profits might be disposed of by the company in one way or another. Mr. Bowen still maintained that a losing venture should not be taxed, because, theoretically, it had nothing with which to pay the tax.

President Lord.—Supposing a merchant had a stock of $100,000. He had it there in actual, tangible goods. He ran the business, and at the end of the year instead of making any money he lost $5,000; would you say for a moment that he ought not to pay any taxes on that stock of $100,000 because he lost money during the year?

Mr. Bowen thought the merchant received a certain amount of police and fire protection, which would cost the commonwealth something, and it should receive a return for its expenditure on his account. In other words, it is "ready to serve" him, according to Brother Doherty, and this ought to be paid for. He thought very few companies would run their books in such a way as to mislead themselves, if they could help it, and that there was at least a reasonable degree of honesty in the managers of corporations, as well as among private individuals, that would not permit them to willfully misrepresent to the taxation authorities the condition of their business. He thought in the matter of taxation of public service corporations, there was no question but that their methods of bookkeeping and their books should be open to the authorities, and this would be a sufficient check upon any condition of affairs which would be misleading as to the profits.

A. M. Barron thought the assessment of public utility property should be made on the physical value, rather than on the gross or net receipts, because bookkeeping is so susceptible of manipulation. In Indiana the material and physical value of the property is taken in making the assessment.

Mr. Pearce said that in Michigan the Board of Taxation Commissioners levy on tangible value, or property, and also on the intangible value, or franchise; so that they are taxed on franchise, as well as on physical property. He mentioned some cases of inequality of taxation in his State.

Mr. Gille: "We are being taxed now on the so-called physical properties of the plant, but we would very much prefer a gross earnings tax. We believe that everybody up in our country prefers a gross earnings tax, on the ground that it is a great deal better than to be placed in the hands of an assessor, who does not know very much about the property. At the same time a gas, electric or street railway property is such that it is pretty hard to tell what the value of it is, and I do not think there is any question but what in a very short time the entire country will place electric, gas and street railway properties in a parallel line with telephone and railway properties, and I think it ought to be done, and I think it is the only way to get at a fair valuation of the property."

NEW RULES FOR ELECTRICAL CODE ENDORSED.

The committee appointed the day before to consider the proposed additions to the National Electrical Code, submitted to the association by the council of the American Institute of Electrical Engineers (which is securing the views of electrical men on the rules before action is taken by the Underwriters' National Electrical Association), reported in favor of the rules as they stand. The proposed rules adopted by the joint committee are familiar to the readers of this journal.

The committee reported that it had conferred with a number of the members, who would be most interested in this matter, and that all seemed to think there was nothing against their interests in this joint report. The rules mainly take the form of suggestions.

Mr. Gille said that this report referred only to outside construction of constant-potential circuits of over 5,000 volts, and, therefore, affected only transmission lines. He thought the regulation proper, and recommended it to the American Institute of Electrical Engineers some time ago. He considered it perfectly proper that the association should endorse the proposition. After some discussion the report of the committee was adopted and accepted.

STANDARD ADVERTISING SIZES ADOPTED.

The report of the committee on standard sizes for advertising matter which was presented the day before, was the subject of a lengthy discussion. All seemed to agree that there was great need for such standards. The discussion was mainly on the best way to further the movement, in order that it might be made national, rather than purely local, among electrical organizations, and that headings and subjects might be formulated for convenience in filing. The discussion was taken part in principally by Messrs. Almert, Gille, Bowen and Barron. It was finally moved and carried to adopt the report of the committee, and to continue the committee, that it might push the work further and bring the matter before other electrical bodies.

J. W. Shuster, of the University of Wisconsin, then read a paper on the subject of

RATES AND METHODS OF CHARGING.

Six methods of charging were outlined. The flat rate, the meter rate, the Wright maximum demand, the Doherty rate, the four-C system and the double-rate meter. The only apology for mentioning the flat rate, is the fact of its existence. The fact that the station has no check on the length of time the lamps are in use makes it obvious that the flat rate is unjust and entirely devoid of business principle. The rate should be refused entirely or made so high that consumers would prefer some meter rate. In dealing with most commodities, a charge on the basis of product delivered is generally equitable. The plain meter rate does this, but the supplying of electric power deals with conditions of investment that are seldom if ever met with in other lines of business. These conditions require the working out of special systems of charging more equitable to company and consumer. The various methods of charging outlined at the opening of the paper were then described in detail, the Wright demand system as developed in England being first taken up.

Mr. Gille: "This is a very interesting paper to me and probably is to every one, and is a subject which will bear considerable study. I would like to take issue, however, with Mr. Shuster on one point. He says the only apology for mentioning the flat rate is that it is in existence. I differ with him there. I believe that there is a large amount of business in every central station, be it large or small, that can be gotten on a flat rate better than it can in any other way. I refer to sign lighting and window lighting. That is a class of important business which you cannot get on meter rates, but you can get satisfactory compensation out of that class of business on flat rates. In a big city that class of business is very important."

President Lord: "In reply to Mr. Gille, I will say that I have tried flat rates, and have tried meter rates; and I tried the flat rate on the window and design lighting, charging so much a month; but the trouble with our customers was that they would go home and leave the lamps burning all night, and I could not get an adequate rate. But I realized that they should have a lower rate for that window lighting, so I simply connected my window lights and side lights on a separate meter, and I said, I will make you a special rate for your window lighting; that was done, and the plan proved successful."

Mr. Gille: "In very large cities inspectors are employed for all night service, and any man that burns his lights longer than his contract permits pays extra for it."

Mr. Almert: "I think Mr. Gille's scheme works out all right in the congested districts of large cities, where they must have an inspector all the time, and it is a policy in most of the big cities to have such service connected with service boxes, and the lights are thrown on and off by an employee of the company; but I do not think it would work out in small cities."

Mr. Gille: "I neglected to say that there are quite a number of time switches on the market at the present time; we are using quite a number of them, and believe that the use of the time switch solves this question. The time switch throws the sign in and out whenever desired."

Mr. Shuster: "As to signs, that question has been discussed by very many authorities who have had a great deal of experience in station work, and they differ very much as to the advisability of giving a flat rate on sign work, or on giving a special meter rate, as has been suggested. In regard to the flat rates, one of the objections has been mentioned as being due to the fact that they burn the lights longer than is specified in the contract, and the other objection is that there is quite a considerable objection to giving a special rate in cases of that kind, from the fact that when you commence giving special rates for any particular kind of service, there is no end to the number of special rates that you can make."

Mr. Almert: "I have found that the great difficulty with many of the small store owners who would like to have electric signs is the first cost, and I have found it profitable to make a proposition similar to this, that the central station sells him an electric sign and makes him a rate of so much a month, by which he pays for that sign, and also for the current consumed. Included in this is the cost of an automatic switch on the premises, instead of a meter, which is taken care of by an inspector who winds it every 7 or 8 days, and changes the time of the clock as the dusk hour changes."

HOW SOME PLANTS COULD BE MADE TO PAY BETTER.

Prof. Geo. D. Shepardson, of the University of Minnesota, was on the programme for a paper on the subject, "The Economic Value

of Testing." He said that there is a tradition abroad that some trusting superintendents believe everything that is told them or that they read or hear in regard to the claims made by manufacturers. Now, it is sometimes suspected that manufacturers and particularly their selling agents, wax enthusiastic as they continue to present the advantages of their particular apparatus, and their enthusiasm is always on the increase. Some things that they wish were so they soon believe are so. If the station man accepts everything that is claimed he sometimes awakens to the fact that he has been deceived. Not that the manufacturers intentionally deceive him, but still he finds things are not exactly as represented. Even if they are as represented at the outset it sometimes occurs that equipment is subject to deterioration, and its performance after a time—weeks, months or years—may be very different from what it is when equipment was new. So it seemed to Prof. Shepardson that the topic of this paper represented a matter of considerable importance. He believed that everything should be tested which enters into the cost of production and distribution, from the coal pile to the receiving cashier. So the subject of this paper might very well be, "How Some Plants Could Be Made to Pay Better." We hope to give an abstract of the paper next week.

In connection with the desirability of the 8-hour day, Prof. Shepardson supplemented his paper by saying that he was often invited to recommend men for going into central stations, and the new graduate from a technical course is attracted to station work. "There are opportunities there for a good man, but when they get out and find they have to work from 12 to 20 hours a day for 7 days in a week and no let-up at all, except in the summer time, they find it a pretty serious proposition, and unless the opportunities for advancement are unusual you will find that the better class of technical graduates are going over into the factories, in with the construction engineers, and that they are going into the station operation less and less frequently. Now, it seems to me that that is unfortunate for the central station people. My students have been going less and less frequently for several years into station work, and it is because of the long hours and the slow rate of promotion and low wages which they get as compared with the wages that they can get elsewhere. I am not here making a petition that you go after technical men, because the demand for college graduates exceeds the supply very greatly. I think in the last 12 months I have had fully six times as many applications for graduates as our last year's graduating class numbered, and there is no occasion whatever to beg for jobs; but looking at it from the standpoint of station operation, it seems to me that if the station men could make the conditions of the employees more like those obtaining in other lines of practice, they would secure a better class of men for operating in the stations, and these men would stay longer with one concern."

The Nominating Committee presented the following report: For president, F. W. Bowen, Kenosha, Wis., for first vice-president, H. J. Gille, St. Paul, Minn.; for second vice-president, A. M. Barron, South Bend, Ind.; for secretary and treasurer, Thomas R. Mercein, Milwaukee. For Board of Directors—S. B. Livermore, Winona, Minn.; T. F. Grover, Fond du Lac, Wis.; J. H. Harding, La Porte, Ind.

The report of the committee was adopted and the ballot of the association cast for the officers nominated. The new president was escorted to the chair, and responded to the honor conferred upon him in a few well-chosen words.

On motion of Mr. Almert, the Committee on Standardization of Advertising was authorized to appoint sub-committees in such territories as he sees fit, to work in connection with the committee.

Secretary Mercein said in behalf of the Committee on Consolidation of Electrical Associations, that he did not know whether he approved of the plan or not. He would like an expression as to whether or not it was advisable for the committee to take any action at present, with a view to the consolidation of electrical association interests. His personal feeling at the moment was that it would be best to have the committee discontinued.

President Lord said: "We do not care to syndicate the Northwestern Electrical Association. We have done well. We have a large and prosperous association; and it seems to me, really, that the committee which you appointed yesterday on motion should be discharged."

President Bowen called attention to the fact that there were a number of gas associations, but none of the State associations had in any wise drawn from the strength of the membership or the work of any larger associations. He thought that both the National Electric Light Association and the Northwestern Electrical Association would both continue to grow stronger as time goes on.

Mr. H. C. Wirt, of the General Electric Company, Schenectady, N. Y., was then introduced and read his paper on "Automatic Voltage Regulators." By way of introduction, he said that Prof. Shepardson's paper revealed a bad state of affairs in central station practice due to improper voltage regulation. The paper to be read would suggest methods to correct these troubles.

During the reading of his paper, Mr. Wirt said: "It is the custom of lamp manufacturers always to find out whether their customer has an alternating-current plant or a direct-current plant; that is, they know by practical experience that it would be useless to send a high-efficiency lamp to an alternating plant, although I think with the high pressure the reverse condition ought to occur; that is, you would expect with that high pressure that the alternating plant could run with less drop and therefore the alternating plant should use higher efficiency lamps than the direct-current plant. The tables issued by the incandescent lamp manufacturers are not taken as they should be by the central station men. Think of only one volt variation on a 100-volt circuit decreasing the life of your lamps 18 per cent. I think it is physically impossible for a station to-day under practical conditions, to keep good voltage (that is within a volt). A great many think they are doing it, but put a recording chart on and you will be surprised at the result. We are all studying methods to improve our condition, and I think it is a case where a little expense will do a wonderful lot of good. Most of you know cases where by spending a lot of money you can improve your conditions somewhat, but what you are looking after is where a few hundred dollars will do a great deal for you; and I think voltage regulation is the place to put your money."

Mr. Gille: "It seems to me that we have got a question before us now that there is not a plant in the country that is not vitally interested in. We are operating a water power plant similar to what Mr. Wirt has described, and we must keep a man at the switchboard and one at the water wheel governor, day and night. Has this system been worked out so that it will handle rotary converters at the end of a 30-mile transmission line?"

Mr. Wirt: "We are working on that line. We can do the work all right on a motor generator set. We are developing regulators to keep motors at absolutely constant speed, and I think we can do something with the rotary converter. Before the regulator was used the cases of trouble that we had from that source were such as to cause us to throw up our hands, and it was practically a question of taking our machinery back.

"It can be arranged so that it would maintain practically absolutely constant voltage at your point of distribution. That is exactly the condition that we had in Colorado, that the circuit was so long, where they had induction motor work, that whenever they started the motors, they would kill the machines—they could not operate in spite of the fact that they had men there to grab the rheostat. But they could not do it quickly enough. In other words, a man cannot catch the rheostat arm and jerk it around 800 times a minute, as the regulator does."

Prof. D. C. Jackson, of Madison: "We have found, as Mr. Wirt says, that to regulate quickly, the arm of the rheostat must be thrown clear around and brought back, which it is very difficult for a man to do quick enough. But this machine does the work. I wish to ask Mr. Wirt, and it is a point that I do not believe would really be troublesome in the regulator, but it seems to me with a very sensitive exciter there would be a tendency for a variation in the voltage passing through the generator field, and I would like to know whether any trouble of that sort has been noticed, from the heating of the fields from the use of this Tyrrell regulator.

"Another point which I think is of interest to all of us who are interested in transmission work, is whether the General Electric Company has taken up, in connection with this regulator, in the compounding of the regulator, the regulating for the inductive drop, which has been taken up to a certain extent I know, by some of the companies, and I doubt not the General Electric Company has done the same. I should be very glad to hear regarding these two points. I know one thing regarding the Tyrrell regulator, that in Burlington, Vt., Mr. Tyrrell put in such a regulator as this, and when I examined that regulator it was a great curiosity to me, but at the same time it seemed to do the work, and I am inclined to think that we have every reason to believe what Mr. Wirt has been telling us

regarding the remarkable operation of this regulator."

Mr. Wirt: "As regards the exciter, we do not notice any flickering in the light. We did until very recently notice a flickering in the light of a direct-current machine, and we were up almost to the point of recommending an independent exciter for the direct-current machine where the flickering was objectionable; but we found that by greatly increasing the rapidity of the relay magnet, we could do away with all the flickering. We have not noticed any trouble with any of the generators operated, in connection with these regulators, in the way of heating fields or otherwise.

"We do not simply go down a little way, but go way down if we want to bring the voltage down. We apply so much energy to changing the voltage that it overcomes any reluctance of the fields, and for that reason we stipulate in the operation of the regulator that the exciter must be one where you have great range of voltage; where you can apply 125 down to 40 volts to get a 110-volt working result. As regards compounding for inductive loads, that is allowed for, and Mr. Tyrrell, who has made a special study of that, says that it compounds for the induction loads."

(Charts were exhibited by the speaker, showing the difference in constancy of voltage with and without the regulator, the charts where the regulator was used showing a constant voltage in every instance, while the voltage where the regulator was not used was quite variable.)

Mr. Almert: "There is one point not quite clear to me, and that is regarding the operation of a number of exciters from the same machine."

Mr. Wirt: "By putting the exciters in multiple you can control the voltage of the exciters; that is, you operate your generators and exciters both in multiple, with one regulator."

MODERN ILLUMINATION.

The lecture by W. D. Ryan, of the General Electric Company, Lynn, Mass., was the best attended of any feature of the convention, the room being crowded to listen to Mr. Ryan's remarks and to see his demonstrations. The lecture was illustrated with lantern slides and with some other optical apparatus. He said in introduction that the subject, properly speaking, should be treated in a series of four or five lectures, and it would be necessary for him to make some very abrupt turns, going from one subject to another, because of the limited time at his disposal.

His introductory remarks and demonstrations were on certain well-known scientific facts regarding light and color, and led up to the point where it was demonstrated that it is necessary to have a white light in order to properly match colors. For instance, if you have a light that has no violet in it, and attempt to look at a piece of material which would ordinarily reflect violet, it would not appear violet at all, but would go down as low as the bronze; so that a piece of violet material, purchased in a light which has not the proper amount of violet, will have a very different look in daylight from what it did under the circumstances mentioned. We must be careful in all lights to get it as nearly daylight balanced as possible. There is an average daylight effect which we can approach very closely with the arc light, but it has not been approached with any other form of artificial light.

He showed, projected on the screen, a photograph of an invention of his called the Ryan chromoscope, which is used for comparing the appearance of the same material under different kinds of light at the same time. This experiment, he explained, was useful in showing prospective station customers the effect that different kinds of light would have in a display of goods.

A diagram was exhibited showing the relative proportion of the different kinds of light waves in sunlight, arclight and gaslight, indicating not much difference between the sun and arclight, as to quality, but considerable difference between arc and gaslight.

The object to be secured in illumination is to get lighting even. Mr. Ryan here showed his new form of concentric light diffuser and also some special forms of diffusers. He called attention to a form of reflector lamp, used at a shipyard over very large ships, so that shipbuilding could be continued at night. The effect is like daylight. There are practically no shadows. This is the first time that ships have been so lighted that the men could work safely on them at night.

The superior quality, volume and unequaled economy of the electric arc is so well recognized that it has supplanted all other artificial lights for high-class mercantile illumination. The open arc, while giving an especially white light of high candle-power, concentrates the most powerful rays in a comparatively small circle within a few feet of the lamp. The circle encloses a dark zone directly under the lamp and beyond the ring of concentrated light, the illumination falls off rapidly and the general result is most disastrous to good lighting, particularly when the goods and surroundings are dark and not of a diffusive character. Not only is it impossible to show material satisfactorily where the light is weak, but merchandise displayed in the strong circle of light is so brilliantly illuminated that in the case of colored fabric the eye fatigues and the complimentary color introduces itself, which robs the original color of its purity. This in many cases causes the customer to become undecided and a lost sale results.

If there was any way of estimating lost business due to this consequential after-effect, the figures would undoubtedly be astounding.

In many stores, fatigue and subjective color effects are partly corrected by the use of dense globes. There still remains, however, equally serious inherent defects, namely, the distortion of the light distribution due to the wandering of the arc, and to the great change in the total volume of light at different increments of time between the so-called picking up and feeding points.

About 1893 several so-called incandescent arc lamps having the defects mentioned, considerably minimized, were introduced. These lamps were of the rack and pinion or clockwork type. The mechanism was of a somewhat delicate character and not sufficiently rugged to withstand rough handling. Further they were fed with high-grade cored carbons of a prohibitive price for general purposes, especially as a pair of carbons was consumed in about ten hours.

The enclosed lamp was placed on the market about 1895 and was soon recognized as having superior advantages of distribution, steadiness and maintenance economy over its predecessors and so rapidly is it replacing the open arc lamps that the latter will in a very short time be regarded as practically obsolete.

The enclosed arc while giving a superior distribution to the open arc is far from perfect and there still remains in a reduced degree the objectionable effect of the wandering arc.

The General Electric Company has been carefully studying this important problem and as a result the concentric light diffuser has been introduced. This apparatus while of an exceptionally simple character, not only cuts down sharp contrasts and diffuses the light equally in all directions, but the effect of the wandering of the arc has been reduced in a considerable degree, so that the light at any point is to a great extent independent of the position of the arc with respect to the carbon ends.

The apparatus consists of a metal diffuser attached to the lamp casing in the same manner as an ordinary reflector or shade. In place of the outer globe a screening shade is used which performs the double function of subduing the light directly under the lamp, while the upper portion of the shade is so shaped that much of the light strikes it beyond the critical angle and is then thrown to the diffuser and added to the direct rays, which naturally go upward. From the diffuser it is distributed, producing a white, even steady light, the general effect of which is most pleasing and the illumination is especially easy on the eyes, being particularly adapted to the matching of colors, which is of the utmost importance in a very large percentage of mercantile lighting. Furthermore, the diffuser makes the illuminating power of the lamp independent of the nature or color of the ceiling; that is to say, it is immaterial whether the ceiling is light or dark. The light will be about equally effective under all overhead conditions, as there will be practically no light lost by absorption, in the ceiling itself.

The semi-concealed arc lamp is especially recommended for use in cotton, silk or other mills where arc lighting is generally difficult owing to shadows cast by high looms and other light-intercepting objects. For printing, calendering, folding and other machines requiring concentrated light the adjustable diffuser has been designed. This diffuser is especially adapted to the lighting of mills with high-studded ceilings or saw tooth roofs. It is so arranged that the light can be "tuned" so as to change the distribution without moving the lamp. This makes it possible to throw more light on a given loom which may require a stronger illumination and this can be satisfactorily accomplished without disturbing the operators on other looms, which would naturally follow a change in the location of the lamp itself.

The arguments advanced in favor of the concentric diffuser may generally be applied to the adjustable diffuser, except that the latter

throws the light only on three sides. The lamps are usually small units and are placed back to back, as shown in the accompanying cut. It will be found that in the majority of cases the concentric diffuser will be most satisfactory, particularly if the mill to be lighted has a low-studded roof or ceiling.

It must be recognized that to give definite data on the amount of light or power required to illuminate a given area is most difficult. Not only does there exist a wide difference of opinion as to volume of light which should be called satisfactory for a given set of conditions, but the conditions are so variable that it is practically impossible to lay down a set rule. For instance, the amount of light required varies with the physical dimensions of the building, the height and color of ceiling (when the concentric diffuser is not used) color of walls, also the number of obstructions in the center of the area illuminated as well as in the nature of the stock; that is, whether it is generally light or dark, etc. Therefore, each building illuminated practically calls for a separate piece of engineering based on the particular condition to be contended with.

Close attention to the matter of general lighting and the compilation of careful data has enabled us to suggest some general figures which will answer for average conditions. We have also added a maximum and a minimum to cover extremely good or particularly bad conditions of lighting. In any case the figures will serve as a general guide.

It will not be necessary to differentiate between alternating or direct current as one set of figures will in general answer for either, nor will it be necessary to consider the size of the unit. If the area illuminated has a high-studded ceiling of say 14 or 15 feet, it is better practice to use say 6-ampere lamps and take advantage of the higher efficiency of the larger units. If, on the contrary, the ceiling is low, say 8 or 10 feet, and there are a number of obstructions which would intercept the light from the various lamps, to get the best effect, it will be necessary to use small units of say 4 amperes. The better distribution of the small units in this particular case would offset the higher efficiency of the larger units. The amount of power consumed per square foot should figure up about the same in either case.

When laying out a lighting plan, if the question arises of a few watts more or less one way or the other it might be well to bear in mind that as an advertising feature, a strong illumination inside associates itself better with the building making the display, than a moderate light inside and an incandescent display on the front of the building. In many cases it would be better policy to add the power expended on the front of the building to the lighting of the interior. This is a point of considerable importance, and is well worthy of consideration, as it would not only act in many cases as a better advertising feature, but would undoubtedly result in increased sales due to the superior light.

WATTS* PER SQUARE FOOT FOR HIGH CLASS ARC LIGHTING.

Building.	Average Conditions.	Range of Variation.
Machine shops, high roofs, electrically driven machinery, no belts	.75	.5 to 1
Machine shops, low roofs, belts and other obstructions	1	.75 to 1.25
Hardware and shoe stores	.75	.5 to 1
Department stores, light material, bric-a-brac, etc	1	.75 to 1.25
Department stores, colored material	1.25	1 to 1.5
Mill lighting, plain white goods	1.1	.9 to 1.3
Mill lighting, colored goods, high looms	1.3	1.1 to 1.5
General office, no incandescents	1.5	1.25 to 1.75
Drafting rooms	1.75	1.5 to 2

* Energy based on watts at lamp terminals.

Mr. Gille: "Why do you take the square feet for enclosed spaces for lighting instead of the cubic feet?"

Mr. Ryan: "If you use the square feet it gives you a constant that is very satisfactory, whereas if you use cubic feet it involves a continued change. You get a better diffusion at a greater height by the method I suggested. As far as incandescent lighting is concerned, you may perhaps use the cubic foot basis there. You have a different condition there. You are not trying to work at such great heights and are on a constant level all the time. But personally, for all kinds of lighting, I prefer the square foot basis, but a combination of the two may be desirable. With this diffuser you can get along with about 25 per cent. less lights, but we are not advocating that. We go to a man and say, you use a diffuser and you will get better light with the same amount of power. We are not increasing his bills, but he will get a better light out of the same number of arcs. In Wanamaker's store there were five arcs and 105 incandescents, and we took out 100 of the incandescents and replaced them with 5 arcs with diffusers, but no more power was used, although the light was much better and much better diffused. In some cases where a man is using a moderate amount of power, say from a watt to a watt and a half, with two sources of light, we put it all together and give him a fine light of one kind. Lights of different kinds do not mix very well. You cannot mix daylight and artificial light, or two artificial lights with much satisfaction.

"With regard to the apparatus used at the shipyard, I would say that it is the best I ever knew. The lights are 60 feet apart running lengthwise of the building and are up 150 feet high.

"With regard to the mirror reflector, I would say that it must be superseded by something better. We have a device now with a highly polished surface which is kept in good shape by the shade, that does very well indeed—better than the mirror reflector which is always getting dirty.

"With regard to the suggestion that the color of the walls as well as the ceilings be added to these data, I would say that all details were not attempted to be placed on the tabulated form, but it is a fact that with a concentric diffuser you are almost independent of your ceiling, and the side walls ordinarily are so far removed from the lamps in store lighting that it is not necessary to consider them. It would, however, be necessary in a small room, of course."

The attendance at the convention was about 25 central station men, and about 40 supply and manufacturing companies had from one to half a dozen representatives each.

Recent Electrochemical Developments.

By Clinton Paul Townsend.

A NEW METALLURGICAL METHOD.

The incandescent electric furnace has never been applied with any signal success to the production of the non-volatile metals. On the other hand, its earliest development was connected with the production of such metals as zinc and sodium, and such metalloids as phosphorus, which are recoverable as products of distillation from a mixed charge. By the term "incandescent electric furnace" as here used, it is intended to include such furnaces as are actuated by the heat developed by the current in a conductor of the first class, as distinguished from the "electrolytic furnaces" or molten electrolytes which are maintained in fusion by the current.

The reason for this non-applicability of the incandescent furnace to the production of the fixed metals is to be found in the fact that these metals have in general a strong affinity for carbon, and that, therefore, the use of a carbon core usually determines the formation of a carbid. If carbon be present in the furnace in proportions not exceeding those absolutely necessary for the reduction, even silicon and aluminum may be produced in elemental form, but in the presence of the excess of carbon represented by the usual resistance core, corresponding carbids are formed.

Of the two suggested remedies, namely the use of a refractory core other than carbon, and the coating of the carbon core with an inert, refractory and heat-conducting sheath, the former is impracticable for commercial metallurgical work; and until the recent brilliant discovery of Mr. Acheson that the carbids themselves possess the essential qualities for the sheath, the latter could be used only for metals of relatively low-fusing point. The production of such elements as silicon and aluminum by this means, a result now accomplished by Mr. Acheson, has been heretofore impossible.

Mr. Acheson's furnace requires only a few words of description. A carbon core, preferably of granular coke, traverses the charge to be reduced, the terminals being electrically connected in the usual manner. Around this core and interposed between it and the body of the charge, is a sheath which may be formed of carborundum crystals, or of silica and carbon in proportions to form carborundum. In operation, this interposed protective material being subjected to the high temperature of the core, is fritted or agglomerated into a coherent layer or sheath which possesses sufficient strength to support the carbon core after the charge has fallen away from it by reason of the reduction of bulk consequent upon its reduction to metal, and which possesses the qualities fitting it for use as a refractory, non-fluxing, conductor of heat. The metal, as aluminum for instance, collects at the base of the cavity formed around the core.

RECOVERING TIN FROM SCRAP.

A patent issued to R. H. Gould, of Surbiton, England, derives its chief interest from a detailed statement of the e.m.f. which may be derived over long periods from the system; tin scrap—sodium chlorid solution—carbon, functioning as a galvanic cell. The process

is simple and new and consists in partially detinning scrap in a chlorid solution by opposing the tin scrap as anode to a carbon cathode. Both tin and iron pass into solution and the current generated by a series of these cells is employed for completing the work of stripping the tin, being conducted for this purpose to supplemental vats wherein previously treated portions of the scrap are connected, again as anodes, in a solution of caustic alkali. The tin is precipitated in both sets of cells in a non-compact or spongy form.

The advantage of the method is that no current is supplied from an external source. Its obvious disadvantages are that it necessitates the double handling of a bulky and cheap material, that the first step involves the solution of iron as well as of tin, and that the tin is not directly recovered in commercially available form.

The Fritz Medal.

At a meeting of the Fritz Memorial Committee, held in New York on January 23, the announcement was made that the four national engineering societies have appointed the following as their representatives on the board of trustees of the Fritz Medal: American Society of Civil Engineers, J. James R. Coes, New York, one-year term; Robert Moore, two-year term; Alfred Noble, New York, three-year term; Charles Warren Hunt, New York, four-year term. American Institute of Mining Engineers, E. E. Olcott, New York, one-year term; E. G. Spilsbury, New York, two-year term; James Douglas, New York, three-year term; Charles Kirchhoff, New York, four-year term. American Society of Mechanical Engineers, Gaetano Lanza, Boston, Mass., one-year term; John E. Sweet, Syracuse, N. Y., two-year term; Robert W. Hunt, Chicago, Ill., three-year term; S. T. Wellman, Cleveland, Ohio, four-year term. American Institute of Electrical Engineers, Arthur E. Kennelly, Cambridge, Mass., one-year term; Carl Hering, Philadelphia, Pa.; two-year term; Charles P. Steinmetz, Schenectady, three-year term; Charles F. Scott, Pittsburgh, Pa., four-year term.

A preliminary organization of the board of trustees was effected and a committee was appointed to prepare the way for a permanent organization.

Water Power and High Voltage Transmission Plants as Investments.

The extent to which long-distance transmission plants are being built in California has been somewhat of a marvel to Eastern engineers, even considering the high price of fuel at the time some of these enterprises were started. While coal is very high in California, the extensive output of the various California oil fields and the cheapness of that fuel in some localities, would naturally lead to the belief that investment in very long high-voltage transmissions would in the future be very limited, because of the comparitively great investment required per kilowatt capacity in a large water power transmission, where expensive hydraulic work must be undertaken and where there must necessarily be a large investment in long high-tension lines. Nevertheless, the building of high-tension transmission lines and the employment of water power on a larger scale than ever before and at greater distance from the market than ever before, seems to have gone steadily on. Perhaps "steadily on" is too conservative a term to apply to the rapid growth that has recently taken place. Most noticeable is that in Southern California, which was the original home of high-tension transmission in America. Around Los Angeles oil is exceedingly cheap. In spite of this fact new and more important water power plants are being developed every year. In one case a range of mountains is to be crossed and power is to be brought a distance of 120 miles from the Kern River Cañon to Los Angeles. George H. Barker, of Pasadena, Cal., who was president of the Edison Electric Company, of Los Angeles, at the time the first 83-mile transmission of that company was started, has been in the East recently on business in connection with the recently formed American Conduit Company, of which he is vice-president. In conversation with Mr. Barker the writer expressed some curiosity to know how it was considered profitable in the Southern California territory to transmit power such great distances with the enormous investments involved, when plenty of fuel oil was available in the city limits of Los Angeles itself, at a very low cost. Mr. Barker's reply cannot fail to be of considerable interest to all who are in any way connected with high-tension transmission work, either in practice or in prospect. Mr. Barker is not now financially interested in the Southern California power transmission. His answer was, therefore, the more impressive. "These companies can prove to you," he said, "that they can transmit power from water power plants to the point of consumption and pay interest on the whole accompanying investment cheaper than they could generate it by steam power if fuel cost them absolutely nothing. While a water power plant is an expensive thing to install, the labor and maintenance required per kilowatt-hour, if the plant is a large one, is a very small item compared to what it is in a steam plant. Water power plants are now considered by investment houses as among the best classes of investment. The Edison Electric Company, of Los Angeles, is having no trouble in disposing of bond issues up to 75 per cent. of the cost of its extensive improvements. Its 5 per cent. bonds are selling at a premium."

Effect of Marconi's Work on Cable Quotations.

One is reminded a little by the decline in cable quotations of the drop in gas stocks some years ago when Edison's work in incandescent lighting was made public. The London *Economist* has the following to say on the subject:

That the progress made by Mr. Marconi has caused some apprehension among the interests concerned is indicated by the market quotations of the securities of the more important cable companies, which are, almost without exception, appreciably below the highest points touched last year. The following table illustrates the position:

	Highest, 1902.	Present price.	Fall.
African direct 4 per cent. mort. debs.	101	98	3
Anglo-American def. ord.	9¾	8¼	1½
Anglo-American pref. ord.	96¾	91	5¾
Commercial Cable 4 per cent. debs.	98½	94	4½
Direct Spanish ord.	3½	3	½
Direct United States ord.	10⅞	10	⅞
Eastern ord. stock	139	117½	21½
Eastern 4 per cent. mort. debs.	113½	106½	7
Eastern and South African 4 per cent. mort. debs.	101¾	100½	1¼
Eastern extension	13 15-6	11	2 15-16
Indo-European	42	40	2
West India and Panama 5 per cent. debs.	103	99½	3¾
Western Telegraph 4 per cent. debs.	102½	98½	4

Eminent authorities have questioned the commercial value of the Marconi efforts, and it is admitted that difficulties which seem to be of a very serious nature have still to be overcome. Yet, when confident predictions of failure are put forward, it is well to remember the opinions that were expressed when the submarine cable had yet to prove itself a success. But so far as the investor in cable companies is concerned, there seems at present no cause for undue pessimism. Mr. Marconi has shown that messages can be sent across the Atlantic by his system, but he has yet to demonstrate that his system can be worked on a paying commercial basis; indeed, before this can be done various difficulties, notably that relating to the tapping of messages, must be obviated. The policy of those financially interested in cable companies should be one of watchfulness, but not of panic.

In this connection it may be well to note that Prof. Willis L. Moore, chief of the Weather Bureau, while on a visit to Yale, delivered a lecture on the work of the government weather reporting system. He says with regard to the use of wireless telegraphy to report the weather and to warn vessels of the approach of severe storms: "Wireless telegraphy has been used experimentally by the Weather Bureau. We found that no system yet devised works with accuracy under varying atmospheric conditions. But wireless telegraphy is in the experimental stage yet. If it ever reaches that stage of perfection so that you can send several messages at the same time within the same magnetic field it will become very valuable to the meteorological service, for then we could flash our storm warnings from our coast stations out to vessels a long distance at sea. I do not think wireless telegraphy will interfere with submarine cables, for where permanent and rapid communication is needed the cable will be the better means. Many government officials, I think, are in favor of government control of wireless telegraph interests. Such control would prevent erection of interfering stations for one thing."

Combined Alternating and Direct-Current System.

By Eleazer Darrow.

In a great many of our cities we have combination power stations which supply street railway power 550 volts to 600 volts direct current and also furnish lighting service from 60-cycle alternators. It would be a great boon to many of these stations and a source of added economy could the alternating and direct-current systems be tied together electrically, so as to work the engines at points near their maximum efficiency. During the day the load of lighting station is usually only a fractional part of the evening and night load, and the peak loads of a railway plant occur between six and eight A. M. and five to seven P. M.

There is nothing radically new in the suggestion that rotaries or

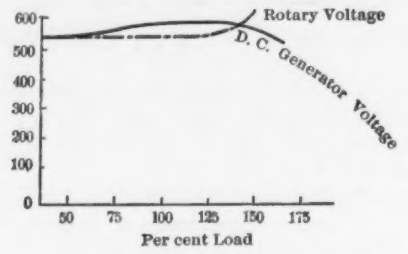


FIG. 1.—CHARACTERISTIC CURVES.

motor generator sets can link the two systems of a combined light and railway plant together, but I have been unable to find, after extensive correspondence with the engineering departments of our leading electrical manufacturing establishments that just the conditions stated below have been met and successfully worked out heretofore.

The main power station of the Cincinnati, Newport and Covington Light & Traction Company contains the following generating apparatus: One 1,000-kw, 550-volt generator; five 400-kw, 550-volt generator; one 1,000-kw, 3-phase, 60-cycle, 4,500-volt generator; two 400-kw, 3-phase, 60-cycle, 4,500-volt generators. The total nominal capacity is thus 5,000 kw, divided into nine units. Normal operation requires at peak loads the operation of five and sometimes six of these units. At minimum load times, viz., between 12:30 A. M. and 5:00 A. M., two engines are required.

We figured that if we could successfully connect the two systems electrically by intermediate rotaries, we could operate peak loads on three engines and minimum loads on one, and get the benefit of

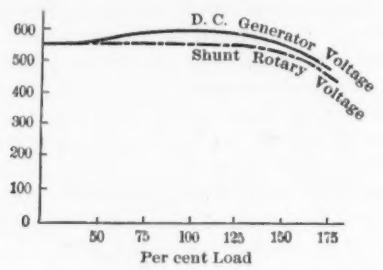


FIG. 2.—CHARACTERISTIC CURVES.

increased efficiencies due to full load conditions and fewer operating units.

An installation was planned of two 60-cycle, 3-phase rotaries, each of 400 kw capacity, having usual overload ratings. I might say right here that our alternating voltage is kept absolutely constant by means of automatic voltage regulators, so that the alternating side of the converters is supplied by constant pressure and hence they deliver constant direct-current voltage when working alternating to direct. On the other hand, the 550-volt generators were over compounded 5 per cent., so that with increasing load the voltage on the street railway busbars reached 575 volts. But when the street railway generators passed the 125 per cent. load point, the engines dropped in speed sufficiently that at 150 per cent. load the voltage was only 560, and at 175 per cent. load 540 volts. The result was that there was a decided tendency for the compounded rotary fed by constant alternating voltage to take more than its share under maximum conditions.

The result obtained can be graphically illustrated by the curves shown in Figs. 1 and 2.

This was serious and was met by changing the compound rotary to a shunt machine. The characteristic curves then were modified to look like those in Fig. 2.

Two things were accomplished by this change: First, equalization under maximum load; second, at light and medium loads, the rotary maintained a practically constant output of amperes, the fluctuation being taken up by the compounded direct-current generators.

Another thing to be very much desired in rotaries for this class of service is improvement of the commutation by the use of a large number of equalizing rings or cross-connecting of commutator bars.

A thing which we anticipated might give us serious trouble was that the fluctuating railway load would interfere with the lighting voltage. However, we have experienced no bad reactive effects at all on the lighting system and at times we have dropped as much as 75 per cent. or 1,000 kw off our lighting busbars and not had a variation of more than 2 per cent. in volts. We are accomplishing all we expected and more in the way of a more economical operation, saving steam, oil and attendance.

Automobile Manufacturers' Association.

On Friday evening the National Association of Automobile Manufacturers gave its annual dinner at the Waldorf, signalizing a most successful week. Every one was delighted with the success of the show, and Mr. Sanger, of Madison Square Garden, was quoted as authority for the statement that the gross profits would reach at least the sum of $40,000.

President Davis was in the chair and Mr. Scarritt officiated as toastmaster. Brief speeches, and to the point, were made by the following gentlemen on the topics named:

Hon. Jacob A. Cantor, President of Manhattan Borough, "The City of New York"; F. L. Smith, "How to Sell an Automobile"; T. C. Martin, "Electrical Matters Pertaining to Automobiles"; Hon. John S. Wise, "What Lawyers Hope for From Automobiles."

It is estimated that the total sales for the week, including agents' contracts, amounted to $4,000,000. One firm received orders for 3,600 light runabouts of a popular gasoline model, and 450 tonneau cars, which was said to be the largest total for any one maker. It is stated that at least two orders were placed for a total of 900 electrical vehicles. At the annual meeting of the National Association of Automobile Manufacturers held last week the question of the next show was thoroughly discussed and there was a tendency toward having it as early in January as possible. Windsor T. White, H. Ward Leonard, Lucius T. Gibbs and F. S. Fish were re-elected to vacancies on the Executive Committee, and I. A. Page was elected to replace W. C. Baker.

New Telephone Patents.

Two telephone patents were issued January 20. Of these one is for a "Telephone System," especially adapted to replace or supplement existing call-bell systems within a building; while the second describes a telephone wall set, designed to facilitate repairs. F. B. Wood, of New York, and K. B. Miller, of Chicago, being the respective inventors.

In Mr. Wood's telephone system a set of telephone instruments is provided for each call station of a hotel or other annunciator system and one special set is provided for the receiving or central station. These instruments are wired specially upon a common battery plan, so that the outlying ones may be inserted directly in the annunciator wiring, replacing the push button of the system. At the central station the wiring changes involve the insertion of a spring-jack in each calling line and some special wiring between the annunciator box and the central station. Of course with this system no intercommunication between outlying stations is contemplated, and the patent even states that the circuits are so arranged that when a connection is established no other station can interfere or overhear the conversation. A study of the circuit, however, shows that one side of the line is common to all stations, proving that this statement cannot be wholly correct, for interfering circuits can be traced for both the transmitter and receiver of any station desiring to overhear or interfere with an existing conversation. One novelty of this in-

vention is a suggested method of calling, wherein an open space cut-out is so inserted in the circuits of the sub-station instruments that a high-potential, alternating current may jump the cut-out and pass through the receiver to produce therein a buzzing sound to serve as a calling signal. The novelty of this suggestion seems rather greater than its practicability.

The invention in Mr. Miller's wall set lies chiefly in the mounting of the hook switch upon the front of the backboard or condenser box in such a manner that both sides, top and front of the ordinary apparatus box may be removed entirely or swung aside on hinges, so that all wiring and apparatus becomes accessible from five directions. This will greatly aid in repairs, the facility of access to the parts being in marked contrast to that in such instruments as have only the top and front of the apparatus box removable. Mr. Miller has assigned his patent to the Kellogg Switchboard and Supply Company.

The Federal Telephone Company.

At a meeting of the directors of the Federal Telephone Company recently held in Cleveland, President Dickson presented a detailed report showing the condition of the company's affairs. It indicated that while there is no doubt as to the ultimate success of the various subsidiary companies controlled by the Federal, the affairs of the parent company are in a precarious condition, and there seems every probability that the stockholders will be called upon for an assessment to place the company on its feet. The company has a debt of $4,000,000, a very large portion of which is due to manufacturers for material furnished for construction purposes. The Federal owns bonds of subsidiary companies to the extent of about $1,800,000 and stock to a par value of $6,000,000. If these bonds could be sold, together with a certain percentage of the stock, allowing the company to still retain control of the subsidiary exchanges, the Federal Telephone Company would be able to pay its debts and retain enough stocks to pay a fair dividend on Federal Telephone stock. Incidentally the report showed that there are 25,244 telephones in the cities served by the Federal exchanges compared with 23,910 Bell telephones. It is reported that the officials of the company have under consideration two plans for the refinancing of the Federal Telephone Company. One involves the disposal of large blocks of the securities of the subsidiary companies under the collateral trust plan, while the other contemplates the formation of a new parent company to have a capital stock of $10,000,000 divided into $2,500,000 first preferred 6 per cent. cumulative stock; $2,500,000 second preferred non-cumulative stock and $5,000,000 common stock. This was noted in our columns last week. The entire scheme, if it is adopted, is to be underwritten by the Everett-Moore syndicate.

CURRENT NEWS AND NOTES.

FRENCH PATENT REGULATIONS.—According to a regulation which went into force January 1, any application for a French patent of which the specification and drawing are not in conformity with the rules, will be rejected without right of appeal, and if corrected, will be dated from the new and not former entry.

MUNICIPAL OWNERSHIP IN CHICAGO.—A telegram from Chicago of January 20 says: Mayor Harrison was defeated on municipal ownership in the city council on Monday night. The vote of 48 to 19 indicates early passage of the Union Traction franchise. The committee of capitalists formed to draw up a plan for complete regeneration of the local traction system includes Messrs. Marshall Field, J. J. Mitchell and Norman B. Ream.

ELECTRICALLY HEATED GLOVES AND SHOES FOR MOTORMEN.—A Dr. Alois Zeckendorf, of Cincinnati, has proposed an electrically heated glove and shoe for the use of motormen in cold weather. The heat is generated by fine resistance wires woven in the fabric of the articles. The shoes and gloves are detachable from the current-supply circuit, and are claimed not to interfere with the movements of the arms and feet. The press dispatch does not say if the motorman is connected direct in the trolley circuit.

WIRELESS TELEGRAPHY IN STORMS.—A dispatch from Sydney, C. B., states that Mr. Marconi took advantage of the recent storm to test the behavior of his wireless telegraph system under adverse weather conditions, and that messages were successfully transmitted. At the same time there was a severe storm along the English coast, but the messages, it appears, reached their destination without trouble.

CAR SPEED.—Governor Bates, of Massachusetts, in his inaugural address, has recommended that right of appeal to the railroad commission should be given from jurisdiction of local authorities over use of and speed on highways, especially by electric cars. It is said that the New York State Railroad Commission will ask the city to pass ordinances providing for such regulation of trucking all over the city as will give the trolley cars freer headway.

HIGHER WAGES WITH ELECTRICITY.—The Boston Elevated Railroad Company has issued an order to its employees granting an increase in wages amounting to nearly a quarter of a million dollars annually. The order provides for an increase according to the length of time a man has served, and in addition for a system of pensions after a certain term of years. Learners who, previously, have been paid nothing while under instruction, are to receive wages, and extra men will be paid while on waiting orders. Previously the Boston Elevated Company paid a higher scale than any other street railway company in the country, and the increase was a total surprise to the employees, and was unsolicited by them.

WATER PURIFICATION is occupying a good deal of attention just now at the hands of electro-chemical inventors. A patent issued last week to Mr. Joseph Johnson, of Minneapolis, Minn., deals with a system for purifying water and other liquids, in which a set of pipes arranged to admit the liquid and a certain amount of air are connected into the circuit from an electrical source, and the walls of the outlet pipe are associated with electrode surfaces. The disintegrating effect of air upon organic substances is well understood, and it is also well known that running water on account of its constant exposure to air is free from impurities. It is evident, therefore, that the water flowing past the suction air tubes will become impregnated with oxygen, and if the water has become tainted or impure by reason of the presence of animalculæ or organic matter it will to a certain degree be purified before reaching the electrodes. As soon as the water enters that part of the pipe between the electrodes the circuit will be closed and the stream subjected to a current of sufficiently high potential to destroy all animal or vegetable life that may have escaped the previous treatment by aeration, so that when the water is discharged from the apparatus it will be purified, safe and palatable for drinking purposes.

ELECTRIC ROADS IN ENGLAND.—A special cable dispatch to the *New York Sun*, of January 17, says: Taking heed of the events of the last session of Parliament, the British authorities are now talking of establishing a royal commission to deal with the whole subject of electric transit in the United Kingdom. The commission would be similar to the existing Railway Commission and would entirely supersede the Parliamentary committee to which the rival propositions were referred during the last session. Its duty would be to recommend the best projects without concerning itself as to whether they are American or English. One important scheme now before Parliament will probably be referred to the new commission. This is the Hammersmith-Piccadilly-Bank of England route, for which various groups have been competing. The prominent rivals now are the Central London Railway Company, which owns the "tuppenny tube," and includes Sir Ernest Cassell and Sir Henry Oakley, and the Yerkes-Speyer interests. The latter to-day offered at par two millions sterling of shares of their Great Northern, Piccadilly & Brompton Railway, which are to be allotted from 200,000 £10 ordinary shares, a dividend of 4 per cent. on which is guaranteed by the Yerkes Underground Electric Railway Company of London. Mr. Yerkes's control of the old Underground District Railway, which for a long time sought to amalgamate with the Metropolitan Railway, is now showing some signs of having practical effect. The scheme was futile two years ago, owing to the fact that the directors of the various companies could not agree on a system of electric equipment. At that time Mr. Yerkes was not sufficiently strong to effect his purpose. His association now with the Speyers and the trebling of the capital put him in a better position to dictate terms.

TROLLEY FARE FREE.—The Nottingham (England) electrical tramways afford such excellent facilities for rapid transit that some of the large shopkeepers in the center of the town are now advertising that they will pay the fares of customers from the outlying districts.

CHINESE TELEGRAPH FINANCE.—The Honolulu stockholders of the Chinese telegraph system have received news that the Empress Dowager intends to seize the telegraph system, giving decorations and orders in payment for stock. We don't understand this, but it is what the cables say about the matter.

ELECTRICAL CONTRACTORS' ASSOCIATION.—The Electrical Contractors' Association of New York State has elected the following-named officers for the ensuing year: President, S. Davis, of New York City; vice-president, G. Barnes, Albany; secretary, William J. Davis, Ithaca; treasurer, J. C. Stearns, Buffalo.

WIRELESS TELEGRAPHY FOR ITALY AND ARGENTINA.—The Minister of Posts and Telegraphs, Signor Galimberti, has announced that at the reopening of the Chamber of Deputies he will ask for an appropriation of $150,000 to erect wireless telegraph stations for a service between Italy and Argentina. The work will be directed by Signor Marconi.

LAW OF LIGHT AND ELECTRICITY.—A cable dispatch from Paris of January 21 says: At a meeting of the Academy of Science to-day Henri Poincaré announced that American and French scientists were co-operating in a series of experiments on the law of light and electricity. The Carnegie Institution of Washington, D. C., will defray the expenses of an American expert who will arrive here soon to take part in the experiments.

STATE ELECTRICAL LABORATORY.—The board of directors of the American Institute of Electrical Engineers, at a recent meeting, passed a resolution, by unanimous vote, disapproving of the establishment on the part of the State of a laboratory and standardization bureau. The recommendations of the State Electrical Commission, appointed by the last Legislature, that the State act as a technical arbitrator in disputes between lighting, railway or power companies, and municipalities or other consumers, was also generally opposed, on the ground that an amendment to the Constitution would be required to make such a law possible, and that in practice the plan would not be practicable.

FRENCH SUBMARINE BOAT.—A cable dispatch from Paris of January 24 says: It has just been announced that the construction is to be undertaken of a submersible boat, the dimensions of which will surpass those of all submarine boats built or building in France. The construction of the boat will be begun this year. Her displacement when submerged will be 350 tons, as compared with the 266 tons of the Gustave Zede, which heretofore has been the largest submarine boat. She will be 49 metres long, 4⅕ metres broad, and will have a draught of 2¾ metres. She will have a single screw and four torpedo tubes and will cost £50,000. The new boat will be able to attack an enemy's ports, and will also be able to cruise on commercial routes. It is expected that the new boat will be built in two years.

THE TISSOT SYSTEM.—The *New York American* sent abroad last week the first wireless press message to cross the Atlantic. In its reply the *Paris Temps* said: "Thanks to the *American* for its message and congratulations. From a humanitarian point of view, wireless telegraphy is worthy of all praise and Marconi has given great results. We have an analogous system in France; ours is the Tissot system. It is a great thing for journalism, especially when a property right in news can be established. One can have a special code by which to do this, and when certain obstacles have been surmounted it will be full of the richest results." The *Paris Figaro*, in its reply, remarked in a somewhat chauvinistic spirit: "Ducret, Tissot, Rochefort and Marconi are the heroes of wireless telegraphy." We are glad that it did not forget Marconi. What about Hertz?

THE AUTO SHOW, in New York last week, moves on to Chicago. It was a great and worthy success, with record-breaking sales and attendance. It is said that a firm building electric trucks of two or five tons capacity sold forty of them. At any rate, it put up on its stand the names of those who had ordered them. A few statistics of the show reveal what tendencies were manifested. Of 84 distinct makes of cars 69 had wood wheels, 11 wire wheels and 4 tubular wheels. Fifty had detachable tires, 23 hosepipe tires, and 9 had solid tires. Fifty-five had wheel steering devices and 27 lever steering. Of 65 different makes of gasoline cars shown, 39 had vertical motors and 26 horizontal; 35 had the motor in front and 30 had it in the rear; 20 had the motor in the back, but a hood in front. Forty-four used batteries for sparking purposes, 5 used a dynamo or magnets and 16 employed both. Just a dozen cars showed mechanical inlet valves, 34 had a single chain drive, 11 had double chain drive, 18 used bevel gears and 2 spur gears. The electrical exhibits were illustrated and described in these pages last week.

LETTERS TO THE EDITORS.

Improvement of Rapid Transit in New York.

To the Editors of Electrical World and Engineer:

SIRS: The idea recently occurred to me that if a "second story" were added to the present Manhattan Elevated system, the rapid transit problem of New York would be solved for a number of years at least. An uninterrupted express service could be established for all trains on the "second story," while a strictly local business could be maintained on the present or first floor.

Moving stairways could conduct the express passengers to the "second floor" from and to the street and at the express stations, which could be placed at three-mile intervals; communication could be had to the local trains on the first floor on the payment of another fare. By making the intervals between the express stations—say three miles—a very rapid transit could be obtained.

With the above idea in view, I examined recently the various portions of the Manhattan Elevated Railway of New York, which at first thought would present the most difficult engineering problems, if the following suggestions were carried out and adopted I find that a "second story" could be added to the Manhattan Elevated without difficulty.

Electric transit could be used on the present tracks and steam or electricity could be used on the second story. Steam would have none of its present objectionable features on the second floor, would be less costly than electricity and use could be made of the present engines. Electricity being used on the first floor tracks, the second story express passengers would not be inconvenienced by the smoke, dirt and steam.

I find that in many localities the present foundations for the supporting columns could be used for a new column supporting the girders for both sets of tracks and at the One Hundred and Sixteenth Street curve the present tracks could be lowered and the second story tracks need be but slightly higher than the present tracks, at that point. Of course at many parts of the line new foundations and independent supporting columns would be necessary for supporting the second floor track girders.

I doubt very much if the cost of superimposing a second floor on the present system would cost as much as the original cost of building the present system, omitting of course the obtaining of the original right of way, which in this case would be eliminated entirely.

From a financial standpoint, the difference in cost between this method of providing a double track from the Battery to One Hundred and Fifty-fifth Street with express service uninterrupted by local service, and the cost of the present tunnel, would probably build another elevated system, or another Brooklyn Bridge.

BALTIMORE, MD. JAMES E. HEWES.

[This is quite interesting, but not at all new.—EDS. E. W. & E.]

The Sleet Problem.

To the Editors of Electrical World and Engineer:

SIRS: In a communication made by me some three years since to another journal, the device of R. H. Dalgleish, chief electrician of the

Chevy Chase division of the Capital Traction Company, of Washington, D. C., for the spreading of oil on the overhead trolleys of the Chevy Chase road was illustrated and the experiments with it described. The device was so successful in conquering sleet storms that its use, so far as I know, is continued up to the present. The principal point in the "trolley greaser" was that it applied the oil by rolling contact through a grooved wheel, exactly where it was needed to prevent ice coating on the trolley wire. All ice that formed was easily scattered by the trolley wheel of a passing car without any arc resulting. The oil spread itself around the wire, and two or three coatings a winter were all that were necessary to keep the road running when forty miles of competitive trolley road were tied up for days at a time. While oil accumulations made soldering operations more difficult, the breaks occurring along the line were so few that this objection became insignificant. The device described worked, kept the line open and cars ran on schedule time, which is the all-important thing in street railway operation. I would recommend a careful investigation of the economy and simplicity of the trolley greaser for fighting possible sleet storms.

PITTSBURG, PA. J. B. ALEXANDER.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Tandem Connection of Induction Motors.—BRESLAUER.—A long article in which he discusses by means of diagrams the tandem connection of induction motors. He shows that there is a possibility of varying the speed within rather wide limits, but there are inherent disadvantages, especially a very poor power factor. He gives the theory of the case in which the two motors are connected together by means of a gearing, and shows that this method may be applied to traction. It has the advantage that both motors may have a small number of poles, and a relatively small diameter. In a special case in which the diameters of the gear wheels have the ratio 4 to 10, he shows that if the speed of the first motor alone is 100, then that of the first and second connected against one another is 66.7, that of the second motor alone is 40, and that of both connected in tandem is 28.5; hence, the variations of speed are within the limits of 1 to 3.5. Yet for practical application, it is necessary to compensate for the phase difference.—*Elek. Zeit.*, January 1.

Theory of the Gramme Ring.—K. R. JOHNSON.—An article pointing out that the laws regulating the generation of a current in a Gramme ring do not constitute a special case of the usual alternating current laws. The length of wire of the coil practically contains an artificial wave equal in length to the length of the wire, and generally shorter than the natural wave-length. In consequence of the compulsion exercised by the rotation, this wave is propagated along the wire with a velocity equal to the rate of rotation, but in the opposite sense, so that, as a matter of fact it is stationary. But if the Gramme ring is given such dimensions that the length of wire becomes equal to the wave length corresponding to the rates of propagation of the wire waves under the influence of the iron core, the current must reach a maximum and so must the potential, since the wave undergoes no compulsion by the length of the wire. In a case which is quoted, the rate of propagation of the wire waves under the influence of the iron core is 1,500,000 meters per second or more, and the length of wire required in the winding for proper resonance is 30,000 meters, or 667 kg of 1 mm diameter. This may not be practicable, but it would yield a higher efficiency if it were.—*Phys. Zeit.*, December 15; abstracted in Lond. *Elec.*, January 9.

REFERENCE.

Three-Phase Transformers.—KOENIG.—An illustrated description of a graphical method for predetermining the current and voltage values occurring in the external circuits of a three-phase transformer, when the load is not balanced.—*Elek. Zeit.*, January 8.

LIGHTS AND LIGHTING.

Incandescent Lamps.—SWINBURNE.—In the course of his presidential address to the (Brit.) Inst. Elec. Eng., he also discusses the problem of incandescent lamps. The limit of efficiency of ordinary incandescent lamps is chiefly due to the variations of supply pressure. The sensitiveness of the carbon lamp to pressure, limits the practical variation of pressure of supply, and thus costs heavily in mains. If we had incandescent lamps which did not mind 20 per cent. pressure variation, a great saving in mains would be possible. Recently the demand for "ballast" for the Nernst lamp has led to the introduction, for that purpose, of little bulbs containing fine iron wire heated to the critical point. This ballast may also be used in series with the incandescent lamp. Solomon found that a small resistance will allow a lamp to be run nearly at its maximum safe efficiency in spite of pressure variations, while a large resistance will enable lamps to be run from tramways and other varying pressure circuits with good overall efficiency. He makes some remarks on carbide filaments and on the Nernst lamp. He thinks that the whole subject of the Nernst lamp is very obscure. "We cannot say we have got anywhere near our limits of high temperature efficiency of running, low temperature in starting, or high pressure in the electrolytic lamp."—Lond. *Elec.*, December 26.

REFERENCE.

Photometry of Electric Lamps.—FLEMING.—The first part of an illustrated reprint of his paper, an abstract of which was recently noticed in the Digest.—Lond. *Elec.*, January 2.

POWER.

German Power Plant.—A description of the electric light and power transmission from the Berggeist central station, at Badorf, near Cologne. As there is no coal proper found in the neighborhood, but there is lignite, the company owning the lignite mines has installed a power plant at the pit's mouth. This is not the first example of lignite entering into direct competition with coal in the European continent, as the Dresden municipal electric plant burns lignite successfully. At Badorf, three engines of 110,475 and 900 hp respectively, are installed, and a 1,200-hp unit is soon to be added. The engines drive three-phase generators, the voltage being 5,700. The consumers are supplied through transformers with current for light at 110 or 220 volts, and power at 220 volts. The district is chiefly agricultural; the Catholic churches want light for the early masses, the farmers use motors for their machines, and small and large manufacturers claim a good deal of power. One firm of carpenters, for instance, has motors installed aggregating over 100 hp, but requires even in busy times rarely more than 32 hp at a time, so that it has so far been possible to put down installations for four times the actually available power. There are 13 factories with motors, aggregating 736 hp, joined to the central station. The maximum charge for light is 12 cents per kw-hour. Power is supplied at about a third of the light rate, the maximum charge being 4.32 cents per kw-hour.—Lond. *Eng'ing*, January 9.

Electric Power in a Printing Office.—REYVAL.—An illustrated description of the new electric installations of Draeger Brothers, a French printing firm. There was required the possibility of wide speed variation for the printing machines and at the same time good light. To meet both conditions a double distribution was adopted: The first, using the two-wire system at 120 volts, supplies all the lamps (100 incandescent lamps, 9 arc lamps and the photographers' lamps); the other, using the four-wire system, supplies the separately excited motors, the voltage being either 120 or 170 or 220. Fifteen motors are installed, 12 of which are driving the presses. The plant contains two generating sets of 30 kw at 120 volts and two boosters of 250 amp at 50 volts in order to raise the voltage from 120 to 170 and 220.—*L'Eclairage Elec.*, January 3.

TRACTION.

Localizing Faults on Tramway Systems.—JOHNSTON.—An illustrated description of the following method for finding the position of a fault with a fair degree of accuracy and rapidity, from the generating station of a tramway system. The connections in the station are shown in the adjoining diagram. The testing current should

be comparatively great so as to get an appreciable reading on the voltmeter *V*, one terminal of which is permanently connected to the auxiliary bus-bar, the other being put to the far end of the feeder to be tested by means of a pilot wire laid for the purpose. The cost of the pilot wires are the chief objection, and they should be put in at the same time as the other cables. One pilot wire is necessary for each terminus, at which place they are connected to the trolley wires, preferably through fuses. The diagram shows the connections for the case in which feeders go out from the central station in four different directions. All of the four feeders are brought to ammeters *A*, and these are connected to the hinges of single-pole change-over switches. The ordinary working posi-

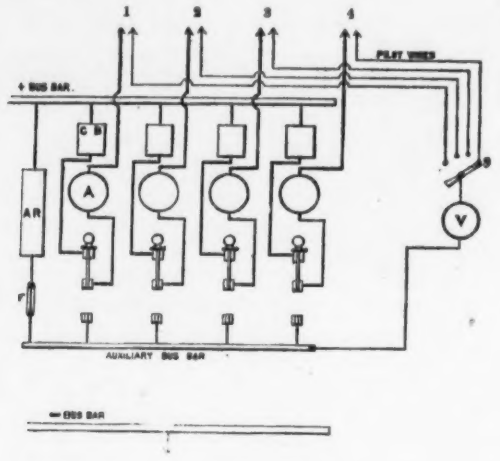


DIAGRAM OF CONNECTIONS.

tion of these switches is on the upper contacts; the feeders are then connected through circuit-breakers *C B* direct to the positive bus-bar; but if a switch is changed over to the bottom contact, that feeder will then be connected to the positive bus-bar through an auxiliary resistance, *A R*, which if there is a "short" on the feeder, will keep the current down to a reasonable figure. While this testing current should be large so as to get a distinct reading on the voltmeter, yet, if it is too large, it may burn through a trolley wire or destroy a length of cable; 50 to 100 amp should be safe. A large scale map is required, of the tramway lines and feeders, and the resistances of the latter are marked at all points where they change in sectional area and at junctions, such as feeder pillars, etc. When a fault occurs, the switch of that section is put on the bottom contact, the low-reading voltmeters, *V*, is put between the far end of the feeder and the auxiliary bus-bar by means of the small multiple way switch, *S*, thus showing the drop in volts along the feeder (and the trolley wires, if they are connected in parallel with the feeder) to the fault, this drop is divided by the value of the current shown on the feeder ammeter, and the map is then consulted to find the position of the fault. A similar method of testing is to take the drop in volts in the rails instead of on the feeders. A numerical example is added.—Lond. *Elec. Rev.*, January 9.

English Conduit Tramways.—A well-illustrated description of the municipal Bournemouth tramway system, which, with the Blackpool, is the first public tramway on the slotted conduit system to be opened in England. Parts of the line are on the overhead trolley system, so that the cars are equipped with ploughs which can be lifted up out of the conduit when the car leaves the conduit portion of the track for the trolley sections. There is at present an equivalent in single track of 3 miles conduit line and 15 miles of trolley line. The slot is a side and not a center slot; otherwise the construction is very similar to that of the London County Council. The slot is 1 in. wide and serves as one of the running rails; it is formed of two rails, held in place by cast-iron yokes embedded in concrete. The plough consists of a steel neck holding a double board of walnut to which the spring contacts are fastened on either side by clips. They are connected by flexible cables to the top of the carrier and thence to a switch which is controlled from a small handle at the side of the car, and which is for switching either the trolley or the plough on to the controller. The plough slides in two sets of guides, one vertical set for raising and lowering it, the other horizontal, both enabling the plough, when lowered, to move freely in a horizontal direction at right angles to the length of the car. The traveling head on which the plough is suspended can move only up and down, but, as soon as this head is in its lowest position, the plough rests on the horizontal guides, and releases itself from the head, thus becoming free to move from the side to the center of the car. At each point on the line at which the slot construction stops and the overhead construction begins, the slot changes from the side to the center, and ends at a plough pit. The municipal generating station supplies both the tramways and public lighting, the private lighting being supplied by a company. The municipal station contains four 292-kw generating sets and a 77-kw motor-generator, the latter being provided in order that the conduit portion of the track (which is run from other bus-bars than the overhead portion, both poles of the conduit line being insulated) may yet be run from the same dynamo.—Lond. *Elec.*, January 9.

REFERENCE.

Electrical Haulage on Canals.—MARCHANT.—The first part of a full illustrated reprint of his paper, an abstract of which was recently noticed in the Digest.—Lond. *Elec.*, January 2.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

British Central Station Statistics.—The annual tabulated statistics of British central stations issued as a supplement. They give concise information on all stations in operation (316 in number) and those in course of erection (41), and in addition to these full details on those projected and a list of undeveloped provisional orders. A general summary of the cost of operation in British central stations was noticed in the Digest last week. The following conclusions are drawn from the statistical table: The increase of the total number of connections is greater than in any previous year. The motor load in London is unmistakably growing, although it is still small. The connections in the provinces are still largely in excess of those in London, and the yearly increase of the former over the latter exhibits a decided tendency towards expansion. The increase in the total number of connections over last year, in both London and provinces, amounts to 103,000 kw, while the connections to date in the equivalent of 8-cp lamps is equal to 17 millions. —Lond. *Elec.*, January 9.

Wright System of Charging for Electrical Energy.—A note stating that while for several years the Belfast municipal electric plant has used the Wright system, yet certain influential consumers became dissatisfied with it, and the Electricity Committee asked the borough electrical engineer, M'Cowen, to report on the subject. His report was in favor of the Wright system and recommended its retention. But at the general meeting of the council which followed it appeared that the maximum demand system was by no means popular, and the report was referred back to the committee. A summary of M'Cowen's report is given in the same issue. He strongly recommends refraining from the contemplated change from the "demand indicator" to the "flat rate" system. He gives statistics which prove clearly that the long hour consumer at a low average price per unit brings far more profit to the undertaking than the short hour consumer at a high average price per unit; the former, therefore, ought to be encouraged by the retention of the demand system. He shows by diagrams that the same capital expenditure is required to supply 20 units at the peak load as to supply 2,400 units spread over the whole 24 hours, and that short hour consumers are an actual loss to the undertaking, while long hour users, paying the lowest price, are the most profitable. He is strongly against the introduction of a general flat rate, but thinks that such a movement for domestic purposes might be worth consideration, as the maximum demand of private houses occurs at a later hour than in the city.—Lond. *Elec.*, January 9.

ELECTRO-PHYSICS AND MAGNETISM

Electrostriction of Glass.—WUELLNER AND WIEN.—An account of an investigation in which they repeated Quincke's experiments on the change of volume of glass under electric stress, but he used as the variable the quantity of electricity in place of the potential. At the moment of charging and discharging the hollow glass condenser, they noted the change of volume by means of a fused-in capillary containing liquid, and the quantity of electricity was simultaneously read by means of a ballistic galvanometer. They found no difference of elasticity in the charged and the uncharged glass, and they were thus enabled to determine the modulus from its behavior under electrostriction. Here, however, they were confronted

by a discrepancy between the value thus found and the modulus obtained by the acoustical or compression method. This discrepancy is greatest (50 per cent.) in flint glass and least in Thuringian glass, the electrostriction value being too high. The compression values are the lowest, and here, again, flint glass shows the greatest variation and Thuringian glass the least. The after effect found by Quincke and Cantone is due to Joulean heat.—*Ann. d. Phys.*, No. 13; abstracted in Lond. *Elec.*, January 2.

Spontaneous Deozonization.—WARBURG.—An article on the phenomenon that if partly ozonized oxygen is left to itself, the proportion of ozone decreases with the time. This phenomenon is known under the name of spontaneous deozonization, and may be due to a variety of causes. The author points out that since the amount of ozone at 200° in a state of equilibrium is inappreciable, such equilibrium can only be attained at ordinary temperatures by complete dissociation of the ozone. The factors bringing about this dissociation may be external, such as contact with foreign bodies or with the walls of the vessel; or they may be internal and due to the collision of two molecules of ozone, or of a molecule of ozone with a molecule of oxygen. He formulates a mathematical theory of the process and finds by suitable experiments that the internal effects are almost altogether due to collisions between ozone molecules themselves. This internal disintegration rises much more rapidly with heating than the external process, and becomes the chief agent at high temperatures. He finds that moisture makes no difference to the stability of ozone at 100°.—*Ann. d. Phys.*, November 12; abstracted in Lond. *Elec.*, January 9.

Photo-electricity.—WULF.—He first describes a new lamp for photo-electric work which gives a powerful light containing a great quantity of ultra-violet rays. It consists of carbon bisulphide in a Mariotte bottle, which enters the wick of an ordinary petroleum burner and is mixed with oxygen introduced into the center of the flame. With this he then studied the relations between chemical and photo-electric effects and found that platinum electrodes with occluded hydrogen are highly photo-electric, whereas in oxygen, chlorine and ozone they lose their sensitiveness. The effect of the medium surrounding the electrode is greater the greater the chemical difference of potential between the two. This matter is closely connected with the question as to whether the dissipation of electricity by light is connected with a chemical process. Lenard did not discover any appreciable decrease of the effect, even in the highest vacua, and this makes it probable that, if the gas plays any part at all, quite minute quantities suffice to produce the phenomenon.—*Ann. d. Phys.*, No. 12; abstracted in Lond. *Elec.*, December 26.

REFERENCES.

Electrons.—OLIVER LODGE.—A reprint in full of a lecture given before the (Brit.) Inst. Elec. Eng., and giving a complete review of the development of the theory of electrons.—Lond. *Elec.*, December 12, 19, 26, January 2.

Alternating-Current Model.—WHITE.—A description of a mechanical model for illustrating alternating current phenomena to students.—*Phys. Rev.*, November.

Oscillating Discharges.—BARTELLI AND MAGRI.—An account of their continued remarks on the oscillatory discharge of a condenser.—*Phys. Zeit.*, December 15; abstracted in Lond. *Elec.*, January 9.

Magnetic Effect of Electric Convection.—PENDER.—An account of his continued researches on this subject, the results being in every way confirmatory of his former results and of Maxwell's theory, while they refute Cremieu's results.—*Phys. Rev.*, November.

ELECTRO-CHEMISTRY AND BATTERIES.

Residual Currents.—BIGELOW.—A long paper giving an account of experiments on what Helmholtz calls "Reststroeme" (residual currents). It is a generally accepted theory that there is a definite minimum e.m.f. required to decompose a certain electrolyte, yet it is a fact that with all electrolytes a current is found to pass with a low e.m.f.; this is what Helmholtz calls a Reststrom; but later experiments have shown that his explanation cannot represent the whole truth. The present author gives the results of a series of experiments which he has made with platinum electrodes. He offers the following new theory: A dissolved gas is assumed to be in a condition analogous to a rarefied gas, some of whose molecules Thomson has shown are capable of carrying positive electric charges, others negative ones. The process of solution is assumed to be sufficient to occasion this differentiation. When a charged gas molecule comes in contact with the metal of the electrode, it gives off its charge; the molecule may then be occluded or remain in solution; in the latter case it increases the concentration of the neutral molecules and thus induces a further differentiation into molecules with opposite charge. If the smallest external e.m.f. is applied there will be a tendency for one electrode to attract positively charged molecules and for the other to attract negatively charged molecules. This theory enables one to say that there is a real and definite decomposition point for each pair of ions under given conditions; any current observed before this value is reached being due to the charged molecules present.—*Jour. Phys. Chem.*, December.

Dry Cells.—ZACHARIAS.—An article stating that the manufacture of dry cells has developed rapidly in the last two years, especially in the production of very small cells, which are very useful for pocket lamps for physicians, travelers, for use in the army, etc. Not one quarter of the depolarizer is utilized in the ordinary dry cell under the usual circumstances. He recommends that in installing electric bells, etc., in houses more attention should be paid to the proper dimensions of the wires, as much of the power of the dry cells is now wasted. Even the best of the small cells, when continually used to light a lamp, last only 15 minutes; they should, therefore, be used only momentarily, but are even then very useful for various purposes. He gives some notes on testing such small dry cells.—*Centralbl. f. Accum.*, December 1, 15.

Diminution of Cathodic Depolarization by Potassium Chromate.—MUELLER.—An account of an investigation of the influence of potassium chromate upon cathodic depolarization, being a continuation of his researches on the effect of soluble chromates in the electrolysis of aqueous solution of the halogens.—*Zeit. f. Elektrochemie*, December 11.

REFERENCES.

Stassano Process.—GOLDSCHMIDT.—A paper in which he reports on his examination of the manufacture of steel in the electric furnace by the Stassano process. He thinks the process is no longer in its first experimental stages and that it deserves consideration.—*Elek. Anz.*, December 25.

Electrolytic Oxidation of Organic Substances.—SALZER.—An account of preliminary experiments on the electrolysis of formic acid and oxalic acid, also of potassium carbonate. The results show the great difference in the reaction and especially in the anodic potential difference with a bright platinum or a platinized platinum anode.—*Zeit. f. Elektrochemie*, December 4.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Portable Capillary Electrometer.—SMITH.—An abstract of a (Brit.) Phys. Soc'y paper in which he describes a modification of the form of capillary electrometer consisting of two wide tubes joined by a cylindrical capillary tube, which may be horizontal or inclined. Certain difficulties are overcome by using a key consisting of a U-tube closed at one end, communicating at the other with a pneumatic pressure ball and containing mercury in the bend; three platinum wires are fused into the tube, so that by squeezing the ball the same change of contacts is produced as by pressing the lever of an ordinary spring key. With the arrangement described, the sensitiveness of the instrument is doubled, and, by using a microscope magnifying 50 diameters, a P.D. of 1/10000th volt can be detected without difficulty. The instrument, used as a surface-tension galvanometer, is more convenient than an ordinary galvanometer with a magnetic system, because there is no suspension, no lamp and scale, and practically no levelling.—Lond. *Elec.*, December 26.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Vacuum Tubes as Lightning Arresters for Telegraphy.—KINSEY.—An abstract of a paper read before the Dublin section of the (Brit.) Inst. Elec. Eng. He describes some observations made in connection with the testing of vacuum tubes when used as lightning arresters. The tubes used in the Telegraph Department of the Post Office are about 1¼ in. long with 1/32 in. air-gap, and they are tested by means of a Ruhmkorff coil, the resistance of the primary winding of which is from 0.1 ohm to 0.15 ohm and of the secondary 350 ohms, the condenser having a capacity of 0.02 microfarads. The coil is adjusted to a ⅛-in. spark-gap and is worked by a single Leclanche cell. Used as a lightning arrester, the tube is connected with one end to earth and with the other to the line; if in good order the colors of the glow at the two ends are blue and green respectively when they are being tested. He noticed that a good tube connected

only at one terminal to the secondary of the induction coil, glowed when the glass was grasped by the fingers. When a bad tube, that is, one incapable of glowing under any ordinary circumstances, was connected between the terminals of the Ruhmkorff coil, and a good tube was brought near for connection in parallel with the first, it was observed that its approach to the bad tube caused the latter to glow fully. Subsequent investigation showed that the effect was due to the approach of the hand, and not to that of the good tube. The bad tube could not be induced to glow by any other means.—Lond. *Elec.*, December 26.

REFERENCES.

Wireless Telegraphy.—REYVAL.—A long illustrated article on the recent long-distance wireless telegraphy achievements of Marconi, the Poldhu station, Marconi's magnetic detector, and the experience of the cruiser *Carlo Alberto.*—*L'Eclairage Elec.*, January 10.

Wireless Telegraphy.—ARCO.—An article illustrated by many diagrams in which he describes how the multiplier may be used for tuning purposes in wireless telegraphy installations.—*Elek. Zeit.*, January 1.

Duesseldorf.—KEHR.—An illustrated description of the new telephone exchange at Duesseldorf.—*Elek. Zeit.*, January 8.

MISCELLANEOUS.

Patents.—An editorial note on British patents which will expire during the coming year. Among them is one embodying the construction of an alternating-current generator, constructed with a single coil for exciting "imbricated pole" field-magnets. The armature is stationary and the field coil is fed from slip rings. The Hellesen cell patent will also expire; the electrolyte in this cell is dissolved in a phlegmy substance such as tragacanth, and the evolved gases are passed through plaster of paris; the outside of the cell consists of two concentric cylinders, the space between which is filled with sawdust or some other absorbent material; there are holes near the top of the inner cylinder and others near the bottom of the outer one; the top of the cell is sealed with pitch, and the gas, in passing through the sawdust, is robbed of its moisture, so that the cell does not get dry. Another patent that will expire is important as it involves some of the principles upon which the successful working of the ohmmeter depends. The method of obtaining the two magnetic fields at any angle, and the elimination of the effect of the earth's magnetic field by means of a permanent magnet free to move on a vertical axis, are the two most important points. The patent for the "Derkert" microphone will also expire.—Lond. *Elec.*, January 2.

Electric Production of Sleep.—LEDUC.—An account of a continuation of his interesting researches on the anæsthetic use of an electric current. His experiments, which were recently noticed in the Digest, have now been extended to the human body, as he performed them upon himself. The voltage was 50 at a maximum, and the current was introduced through cotton electrodes moistened with salt solution, and placed, one on the forehead and another over the kidneys. The potential is reached gradually in the course of five minutes. The faculty of speech is first inhibited and then the rest of the motor system. There is a gradual inhibition of sensation, beginning with a numbing of the limbs. The only disagreeable sensation is the gradual loss of the faculties, which gives the sensation of a nightmare. The heart is entirely unaffected, but the breathing is somewhat obstructed, probably by the strength of the current through the neck, which should be shunted. On breaking the current the awakening is instantaneous and the feeling is one of invigoration. All danger to life may be avoided by switching off the current as soon as the breathing shows a sign of stopping.—*Arch. d'Elec. Med.*, December; abstracted in Lond. *Elec.*, January 2.

Radioscopy for Medical Purposes.—GRUMMACH.—A report on the progress made in the diagnosis of diseases of internal organs by means of Röntgen rays. Contrary to the prevailing usage, he recommends the use of large induction coils giving sparks 50 cm or 60 cm long, as these alone furnish reliable results. He even goes further and uses a coil of 100 cm spark length operated with current from the Berlin electric light mains. Many applications of radioscopic methods have been made to the heart, and the author shows how the best radiograms may be obtained, and mentions that the subject should breathe naturally while they are taken. Gaseous and liquid gatherings, tumors and fibrous aggregations are easily discovered with the eye method. In one case described, the lung was seen to be pressed against the heart, and the liquid gathering was seen to break into waves with the movement of the patient. In another case an abscess in the brain was discovered owing to the calcareous infiltrations it contained.—*Arch. d'Elec. Med.*, November; abstracted in Lond. *Elec.*, December 26.

Electric Separation of Metals from their Ores.—NEGREANO.—A description of what might be called an electrostatic method of separating noble metals from their ores. It is based upon the following experiment: A central disc is cut out of a metallic plate, and the plate and disc are connected with the poles of a Wimshurst machine. If now a powdered mixture of sulphur and red lead is blown upon the metallic surface through a wooden sieve, the sulphur will be deposited upon the disc, and the minium upon the other plate, or vice versa. This is, of course, due to the frictional electrification of the two powders. The author has varied the powders by pounding up a silica rock with malachite, iron oxide and copper oxide. On using the powdered mineral in the same way he found that the metallic particles were separated from the silica. In the case of a quartz rock containing limonite the separation of the gangue on one side from the yellow limonite on the other was easily brought about. Another easy separation was that of pyrites from a matrix of lignite. The author proposes to employ this method for the separation of gold from gold dust.—*Comptes Rendus*, December 15; abstracted in Lond. *Elec.*, January 9.

REFERENCE.

Röntgen Rays for Medical Treatment.—CLEAVES.—A paper on the Röntgen ray and ultra-violet light in the treatment of malignant diseases of the uterus, with a report of an inoperable case.—*Med. Record*, December 13.

New Books.

AMERICAN MUNICIPAL PROGRESS. By Prof. Charles Zueblin. New York: Macmillan Company. 1902. Cloth, 12mo. 380 pp. Price, $1.25.

This interesting volume is one in the Citizens' Library of Economics, Politics and Sociology issued under the editorship of Dr. Richard T. Ely. We cannot say we are greatly impressed with it as a calm and impartial survey of the progress made by cities in the United States, but it will probably find many readers among those who believe that all is well under municipal ownership and all is ill under the régime of private initiative and enterprise. "Public ownership promotes good citizenship" we are told, which goes easily in a city like New York, where the public ownership of important services has been and remains full of crying scandals; so that ceaseless inquiries and investigations are in order, while the struggle to spend revenues equal to those of five or six European monarchies combined, is of the most debauching character. As one might expect, Tom Johnson is held up for glorification, while of C. T. Yerkes it is recorded that when "a more rigid public control was threatened, he decamped." If there was any decamping, it has escaped our notice; although we have observed it in the case of boodle aldermen and gamblers who flourished with the connivance of city authorities.

While there is no chapter on public lighting in this book, and but few incidental references to it, there is a whole chapter devoted to transportation. Municipal telephony also escapes the treatment one might expect. The street railway companies get several sharp raps on the knuckles, some of which are doubtless deserved. We have ourselves taken occasion to condemn certain things; but to jump thence by inference to municipal street railways is a folly we have fortunately avoided, although Prof. Zueblin sees in it "the only way." While his remarks in regard to the Metropolitan Company and its overwork and poor pay for employees are worse than ridiculous, they are matched by his commendation of the fire alarm telegraphs —under municipal ownership—in New York and Boston. So far as New York is concerned, the system is beneath contempt from the electrical standpoint.

Municipal sociology is a valuable study, and this brochure is not bad as a compilation of some of its data, but we take decided exception to its want of philosophical spirit and its assumption that the plain American citizen at once becomes a bad man when he operates a public service corporation.

DIE GEWINNUNG DES ALUMINIUMS. By Adolphe Minet. Halle: Wilhelm Knapp. 130 pages, 57 illustrations, 15 tables. Price, 7 marks.

The book contains a historical summary of the methods employed for the production of aluminum. Chemical methods are first described, and then electrochemical methods. These various processes are described in some detail with the aid of illustrations.

The second part of the book deals with the uses of aluminum. It is shown that in the year 1885 the total world production of aluminum amounted to 14 tons, of which 10 were in Germany, and 1 in the United States. In 1900 there were nearly 4,700 tons produced, of which 500 were in Germany and 1,650 in the United States. Prices for the metal are given, also analyses and physical tests. The use of aluminum alloys is alluded to, and also the applications of such alloys in the arts.

The book is an excellent compendium of elementary facts concerning aluminum and is interesting and instructive to many classes of readers.

IMPROVEMENTS IN THE HUNGARIAN TELEGRAPH AND TELEPHONE INSTALLATIONS. Published by the Royal Hungarian Direction-General of Posts and Telegraphs. Budapest: Hornyanszky and Court. 56 pages, 72 illustrations.

This is a report of experiments made by the Hungarian Bureau of Telegraphs. There are four parts. First, experiments in operating telephone plants directly from a dynamo machine. Second, improvements in the Hughes system. Third, operating Morse sounders without relays. Fourth, duplex telephony. Many attempts have been made to operate telephone exchanges directly from a dynamo. The first 17 pages are devoted to tests in this direction. In common with other efforts, the experiments have proved successful so far as transmission is concerned, but the difficulty encountered lies more in the possibility of a sudden failure of the machine than from any other cause. On this point the report does not touch. The next 30 pages are occupied with tests of the Hughes printing telegraph, directed chiefly toward the selection of a better driving mechanism by the substitution of an electric motor for weights. Part 3 is a short note upon the operation of Morse sounder apparatus without a relay. Part 4 is devoted to experiments upon duplex telegraph and telephone systems. The greater portion of these trials relate to the perfection of telegraphic duplexing. A number of different circuits are worked out and tested with satisfactory results. Altogether the precautions shown to be necessary are so great as to render commercial adoption difficult and uncertain.

JAHRBUCH DER ELEKTROCHEMIE. Berichte uber die Fortschritte des Jahres 1900. By Dr. W. Nernst and Dr. W. Borchers. Halle a. s.: Wilhelm Knapp. 596 pages, 192 illustrations. Price, 24 marks.

Another volume of an excellent and creditable publication which has been appearing for some years. These volumes appear annually and cover the literature on electrochemistry for the year, the present one being for the year 1900. The previous volumes have already been reviewed in these columns, and it may be remembered that the reviewer has had nothing but favorable comment to make. It is certainly a publication which those interested in the progress of electrochemistry should not fail to be without. As was shown in previous reviews, it consists of a series of classified abstracts, many of them illustrated, of all the current electrochemical literature, the abstracts being in most cases sufficiently complete to give the most essential information in the original article, and they also give a very good idea of the nature of the articles themselves, so that if the information that one seeks is not in the abstracts, one will be enabled to see from the descriptions whether or not it is likely to be in the originals. The articles are well classified and intelligently abstracted by men well known to those familiar with the German literature on this subject. It is accompanied by two full alphabetical indexes, one of authors and the other of subject matter; it is, therefore, easy to find anything that one is looking for.

The scientific section is larger than in the former volumes, as it now occupies 313 pages. Nearly the whole of this department has been prepared by Dr. H. Danneel, including chapters on general electrochemical theories, methods, apparatus, constitution, conductivity, electrical energy, polarization and electrolysis, a rather long chapter on discharges in gases, Bacquerel rays, radiant energy, electrical energy, etc. This scientific section is concluded by a brief report on electric analyses by Prof. F. W. Kuester.

The second part, on applied chemistry, was edited by various authors. Prof. K. Elbs was in charge of the sections on galvanic cells, storage batteries and on organic chemistry; while Prof. W. Borchers was in charge of those on inorganic chemistry, electrometallurgy, alkalis, chlorine, and apparatus for electrochemical industries such as magnetic separators, furnaces, electrodes, diaphragm, etc. The volume furthermore contains many statistics, some of which are of considerable interest in such a young and rapidly growing science and industry as this is.

The reviewer is pleased to add that the editors and publishers, unlike some others in Germany, show that they are progressive, as they use the Latin or international type in this publication, thus making it much easier to read by foreigners, and less injurious to the eyes of the natives, than the old German type, which should long ago have been relegated to the melting pot, before it caused the ruin of the eyesight of so many natives and prevented German publications from being read as much by foreigners as the books generally warrant.

THE TELEPHONE GREEN BOOK FOR 1902. By H. H. Robinson. Cloth 12mo. 238 pp. Price, $2. The Telephone Green Book Publishing Company.

This is an excellent compilation of the statistics relative to the independent telephone companies in the States of Ohio, Indiana and Michigan. The directory part is in itself valuable, but is supplemented by three special papers, one on independent telephone work in Ohio by J. B. Hoge; one on Indiana by S. P. Sheerin, and one on Michigan by J. B. Ware. In giving the details of the various companies, Mr. Robinson has supplied information as to capitalization, etc., but we note an absence of data as to rates and as to the style of apparatus, manufacturers' name, etc. This will, it is to be hoped, be given in later editions. At the end is an alphabetical list of the exchanges in each State.

SUCCESSFUL ADVERTISING. By J. Angus McDonald. Cloth, 12mo. 400 pp. The Lincoln Publishing Company, Philadelphia. Price, $2.

This is an exceedingly interesting book on a subject to which the author has given his attention for some ten years. A great many of our readers are concerned to know how best to set forth the merits of their product and meet the keen competition of other manufacturers. Advertising has become a science in the same sense that political economy has, viz., there are many elements in it that can be reduced to definite data and formulæ, and Mr. McDonald traverses the whole field of trade for his facts and principles. The book deals not merely with the preparation of "ad" copy, but the attractive arrangement of a store and, in fact, every feature of the campaign to win the customer's dollars and continuing esteem.

MANUAL OF RURAL TELEPHONY. By J. A. Williams. Cleveland: Manual Publishing Company. 177 pages, 104 illustrations. Price, $1.00.

This is in many respects a remarkable little work. Within its pages the author has endeavored to condense instruction for organizing and financing telephone companies; directions for line construction, sub-station installation, central station outfits, estimates of cost, and a treatise on electricity in so far as it pertains to the telephone.

Considering space, rather a greater success is attained than is sometimes found in such digests, yet the intellectual aliment provided is so concentrated as to require dilution with other knowledge and experience. The book is intended as an aid to the rural electrician, who has been so successful in talking over a few miles of barbed wire fence that he imagines himself a full-fledged telephone promoter, and is trying to persuade his friends and acquaintances to form a company. Directions for this purpose are provided in Part I, Chapter II, containing forms for by-laws, articles of incorporation, stock certificates, etc., together with a few comments upon the advantages presented by various types of organizations. Chapter III gives estimates of the cost of rural installations, some of which would be of the greatest interest if they can be substantiated. For instance, the author estimates telephone poles at 50 cents delivered on the ground, ready for erection, setting poles at 15 cents each, and

connecting subscribers' premises to the pole line at 25 cents each. It is to be feared that locations where such Utopian prices prevail are few and far between. Part II is devoted to directions for building telephone lines and here the author has been more successful in giving plain and simple directions sufficient for the "bean pole" type of telephone construction, commonly known under the name of the "Farmer's Line."

The remainder of the work, Part III, deals with the construction of sub-station apparatus and the simplest form of the switchboards, and in this the writer seems at home, giving clear and lucid descriptions which will be of value to those having telephone stations in isolated parts of the country to which the repair man never comes.

THE LOCOMOTIVE: SIMPLE, COMPOUND AND ELECTRIC. By H. C. Reagan. Fourth Edition, Revised and Enlarged. New York: John Wiley & Son, 1902. 565 pages, 300 illustrations. Price, $2.

This is a new edition of a treatise on locomotive engineering, bringing former editions to date. As a practical man, Mr. Reagan writes directly and successfully to his co-workers on the footboard in an endeavor to explain the principles of the locomotive, the diseases to which it is subject, and the remedies to be applied in the field. The plan of the work is catechismic, consisting of a description of each portion of the locomotive, followed by a series of Questions and Answers. On the whole the style is highly commendable; no useless space is occupied, each sentence is directly to the point, describing some vital portion in a way easily comprehensible by the practical man.

The first 86 pages are devoted to general description of the functional parts of the locomotive. The compound engine is then taken up and occupies the next 160 pages. Succeeding this auxiliary appliances are treated—injectors, steam gauges, air pumps, brakes, etc.—the chapters on brakes and brake appliances being particularly commendable. Next comes a short chapter on locomotive packings, completing the body of the work. An appendix is then added in which the electric locomotive is taken up. This seems to be rather the weakest portion of the work, as considerable space is devoted to the Baltimore tunnel locomotive and the Heilmann. The pages on the Baldwin locomotive are interesting but antiquated, and the Heilmann apparatus has not yet won a place in a description of practical traction engines.

Oil burning locomotives and a section on liquid fuel complete the book. The typography of the book is excellent and it is unusually well illustrated with carefully selected diagrams.

BOOKS RECEIVED.

DIES: THEIR CONSTRUCTION AND USE FOR THE MODERN WORKING OF SHEET METALS. By Joseph V. Woodworth. New York: Norman W. Henry & Co. Cloth. 384 pages, 505 illustrations, 9 x 6 inches. Price, $3.00.

HARDENING, TEMPERING, ANNEALING AND FORGING OF STEEL. By Joseph V. Woodworth. New York: Norman W. Henry & Co. 280 pages, 200 illustrations, 9 x 6 inches. Cloth. Price, $2.50.

Directory of Electrical Societies, Etc.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, Secretary, Ralph W. Pope, 95 Liberty Street, New York. Meetings: February 27th, "Railway Train Lighting," Wm. L. Bliss, Lamar Lyndon and A. J. Farnsworth; March 27th, "High-Tension Lines," Ralph D. Mershon; April 24th, "Tendencies of Central Station Development," H. A. Lardner, Philippo Torchio and Peter Junkersfeld.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES, Secretary, W. H. Johnson, Philadelphia, Pa.

CANADIAN ELECTRICAL ASSOCIATION, Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Toronto, Ont., 1903.

THE ELECTRICAL TRADES SOCIETY (Member National Electrical Trades Association), Secretary, A. P. Eckert, 39 Cortlandt Street, New York. Board of Directors meets every second Friday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE, Secretary, Wm. J. Davis, Ithaca, N. Y.

ENGINE BUILDERS' ASSOCIATION, F. P. Ide, Springfield, Ill., Secretary.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS, Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., September, 1903.

INTERSTATE INDEPENDENT TELEPHONE ASSOCIATION, Secretary, E. M. Coleman, Louisville, Ky.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION, Secretary, H. K. Cole, of Lancaster, Ky.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES, Secretary, W. H. Morton, Utica, N. Y. Next meeting, Detroit, Mich., July 15, 1903.

NATIONAL ELECTRIC LIGHT ASSOCIATION, Secretary, James B. Cahoon, 136 Liberty Street, New York. Next meeting, Chicago, May, 1903.

NEW YORK ELECTRICAL SOCIETY, Secretary, G. H. Guy, 114 Liberty Street, New York.

NORTHWESTERN ELECTRICAL ASSOCIATION, Secretary, T. R. Mercein, 85 Michigan Street, Milwaukee, Wis.

SOUTHERN INDIANA TELEPHONE ASSOCIATION, Secretary, E. W. Pichardt, Huntingburg, Ind.

New Standard Dry Battery Tests.

In selecting dry batteries for engineering work of any kind, it often happens that the cells are selected by mere guesswork only. These circuits are duly designed, the voltage necessary to force the required current through them is computed, and enough primary cells are procured of presumably sufficient capacity to do the work, and if they prove deficient, more or larger cells are substituted.

In order to provide more comprehensive data for the benefit of the engineering profession, Mr. Wm. A. Roche, 42 Vesey Street, New York, has had numerous tests made upon some of his types of battery

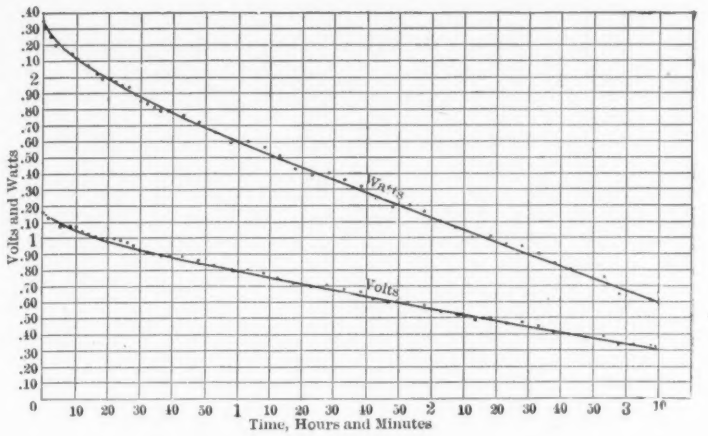


FIG. I.—CURVE OF DISCHARGE THROUGH VARIABLE RESISTANCE.

with the idea of displaying in a thoroughly concise form their energy producing qualities. Curves resulting from these tests are quite interesting, and some of them are submitted herewith. The cells whose tests are illustrated by the following curve sheets are known as the Roche new standard dry battery No. 5. The weight of these cells is 2 pounds. Their internal resistance averages about .12 ohms, their voltage is rated at 1.52, and on short circuit these cells will give from 15 to 18 amperes.

The curves of Fig. 1 indicate the performance of one of these cells discharging through a resistance which is varied so that the current will always be 2 amperes. It will be noted that the starting voltage with resistance in circuit was 1.18, and that it required nearly 3 hours and 10 minutes to reduce the voltage to .3, the voltage falling off almost uniformly with respect to time. On releasing the cell from the test, the voltage rapidly recovered, and in 12 hours the open circuit voltage had returned to 1.20.

Fig. 2 gives the discharge curves of the cell through .179 ohms.

The current started at 5 amperes and at the close of the test was slightly over 2 amperes, it requiring a little over 2 hours and 30 minutes to reduce it to this condition. The voltage of the cell on open circuit quickly recovered within 12 hours to 1.20 volts as in the former case. The watt hours per pound of cell on a 3-hour test was a little over 2.3.

The curves of Fig. 3 are interesting as showing the behavior of the cell on a heavy short circuit and its subsequent recovery. The cell was short-circuited through .056 ohms, and starting with 10 amperes, the current fell off until at 2 hours and 15 minutes it had reduced to a little below 2 amperes. On releasing the cell from its load, the open

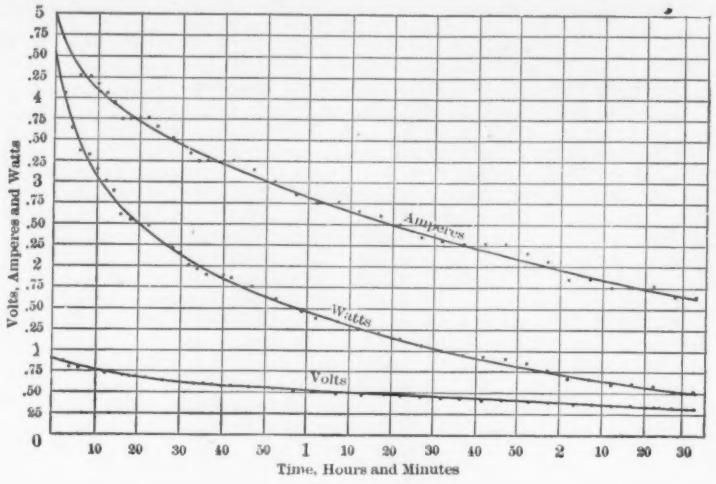


FIG. 2.—DISCHARGE CURVES.

circuit voltage almost immediately jumped to .7 of a volt, and after that by slower increments it rose within 1 hour and 40 minutes to .965 volts. This curve should be of interest to those who employ dry cells for the purpose of bell and telephone work. It shows that such a cell could endure a very severe short circuit and almost immediately recover sufficient voltage to work any ordinary apparatus to which it might be connected.

In all three of these tests the voltage recovery is very prompt, and is very noticeable in view of the fact that these cells are intended for intermittent work. In a subsequent test made on these cells on

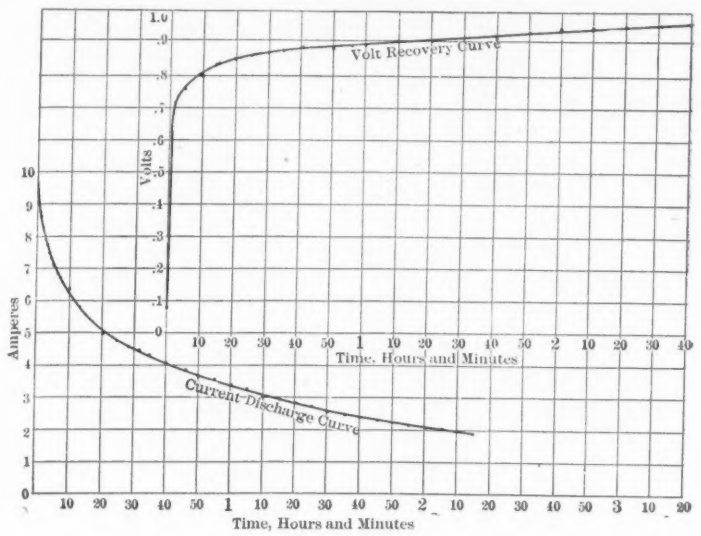


FIG. 3.—CURVES SHOWING DISCHARGE ON SHORT CIRCUIT AND SUBSEQUENT RECOVERY.

interrupted circuit, conditions that would obtain in automobile work being duplicated, the results were very satisfactory. The cell was first tested with a commutator in circuit, which closed the circuit one-thirtieth of the time. The cell when operated under this interrupted load ran for 3 hours and 25 minutes with rests between each hour period. The current was taken with the commutator at rest both before and after the test, as was also the open-circuit voltage. It was found that the current fell almost uniformly from 6.2 amperes to 5.2 during the period of the test, the open circuit-voltage falling proportionately.

Finding that this arrangement would make the test unduly long, the commutator was changed and another was substituted closing the circuit one-quarter of the time. This subsequent test extended over a period of 28 hours of running and 69 hours 26 minutes in rests, these rests being divided up at approximate hour intervals, the aim being to duplicate automobile conditions as much as possible. On the start of this second test the battery was able to force 4.2 amperes through its circuit. At the close of the test it was able to force 1.2 amperes through the circuit, the capacity for delivering current falling off practically uniformly throughout the run. At the close of the test the cell showed a marked and substantial tendency to recover its voltage and current-producing capacity.

A Four-Ported Engine.

A new form of four-ported engine is being built by Mr. W. J. Francke, at New Brunswick, N. J., and is now illustrated and described, we believe, for the first time. It is shown in Figs. 1 and 2.

It has only one valve, designed to give a perfect four-valve steam distribution, and simple in construction. It will be observed that the valve is simply a cylinder with a steam port on one side and an exhaust port on the other, turned on the outside to fit a bushing containing the ports leading to the cylinders and on the inside to fit a tube containing the live steam ports, and is rotated by a pair of bevel gears from the shaft, running constantly in oil.

The valve is connected to the governor by means of a substantial spindle which drives the governor and makes the valve and governor practically one integral part, the valve rising and falling with the motion of the governor in a ratio determined by the relative length of the governor arms. The steam port in the valve, one edge of which determines the lead given to the engine, is cut longitudinally

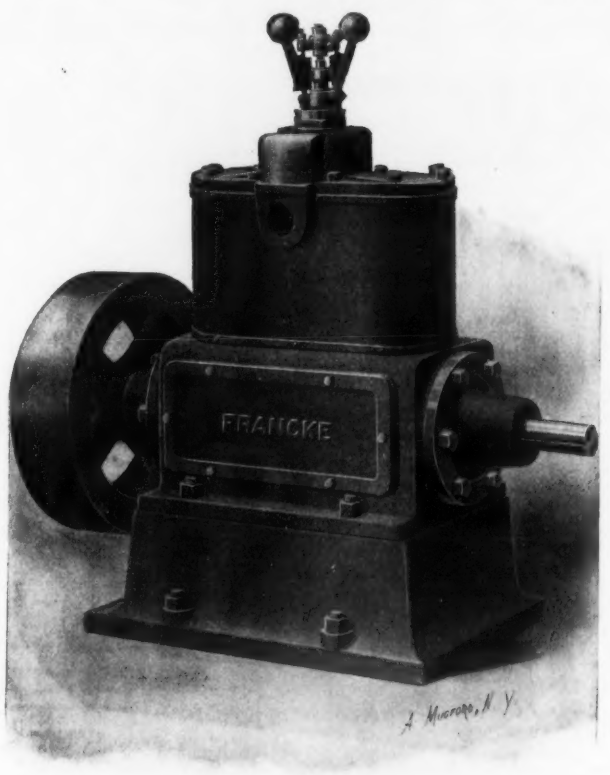


FIG. 1.—FOUR-PORTED ENGINE.

with the valve on its inside diameter, so that the up and down motion imparted to the valve by the governor does not change the position of the valve with relation to the position of the piston, and the lead is maintained constant and may be changed at will without interfering with cut-off, release or compression. On the outside diameter of the valve, the form of the port changes so that two ports are formed which have a slant corresponding to the slant of the ports cut in the bushing in which the valve rotates, consequently when the valve is raised by the action of the governor the cut-off takes place earlier and when the valve is lowered it takes place later, without in any way changing the lead, release or compression.

The exhaust port in the valve is simply a slot cut longitudinally with the valve, one edge of which opens the port and the other edge closes it. As the valve edge which opens the port does not close it, which is the case in every reciprocal valve motion, it follows that the position of the opening edge may be set in exactly that position which is determined by the indicator to be the best for the speed at which the engine is to run without interfering with lead, cut-off, or compression and the closing edge may be set in exactly that position which is determined by the indicator to be the best to get the compression necessary for the economical use of steam and that

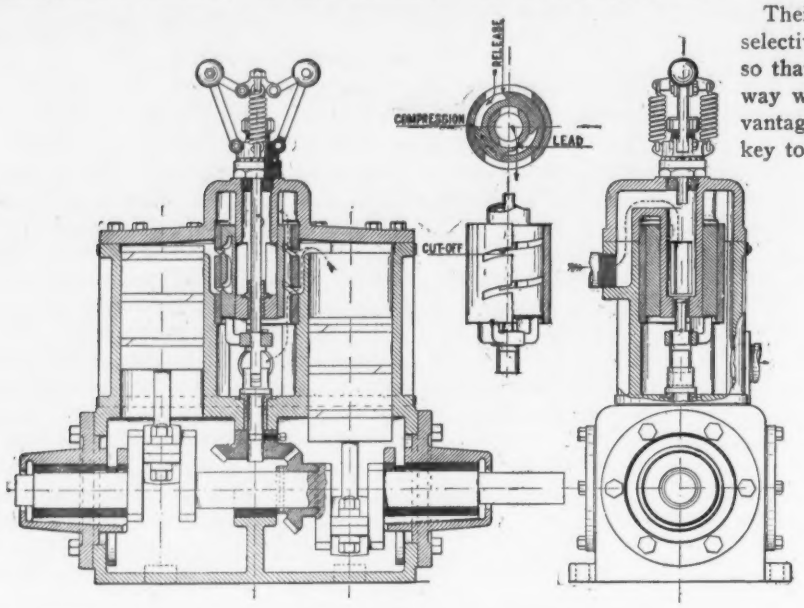


FIG. 2.—VIEW SHOWING INTERIOR OF ENGINE AND CONSTRUCTION OF VALVE PORTS.

smooth running and freedom from shock, which is so essential to high speeds, without interfering with the lead, cut-off, or release.

By referring to the cut, it will be seen that the reciprocating parts of the conventional type of engine have been almost entirely eliminated, leaving only the two connecting rods and pistons, shorn of the usual weight of cross-head and piston rod. The governor is of the centrifugal type, but instead of having heavy, massive weights connected to an eccentric through which they must operate a heavy reciprocating valve mechanism, they are connected directly to the valve spindle itself, both the weight and the valve being driven by bevel gears from the main shaft, operating continually in oil. The governor's only function being to raise or lower a light balanced valve according to the load on the engine, a very close regulation is obtained with very light weights and springs and the simplest form of construction.

For lubrication ring oiling bearings are used for the shaft and an oil bath for the running gear in the crank case. A sight-feed lubricator takes care of the pistons and valves. The exhaust steam impinges on the flat surface of the exhaust valve port, forming an oil separator, which spreads the oil over the entire valve surface; the engine can be run at exceptionally high speed without undue wear or attention. Every engine is tested under steam at full working pressure at maximum speed and varying loads before leaving the works, and is shipped ready to start.

The Francke engine will be furnished when desired without subbase, wheel or governor. The sales are controlled by Thomas C. Maxfield, sole sale agent, with general offices at 120 Liberty Street, New York. The Francke engine is furnished with either automatic or with throttling governor, for direct connection or belting to anything. Sizes now ready are 5 hp to 25 hp. The smaller engines run as high in speed as 1,000 r.p.m.

Monoplex Intercommunicating Telephones.

The Atwater-Kent Manufacturing Works, of Philadelphia, are bringing out intercommunicating instruments similar to their two-station monoplex telephones that have been on the market for the past year. The success of these instruments for a two-station line and the many demands that this company has had for an intercommunicating system that would give equal satisfaction, led the concern soon after these instruments came out to give the matter their attention, with the present result. They made a careful study of the requirements of systems for various uses and developed them by installing them in a large number of places that have given a severe test of their reliability and convenience. The "monoplex" instruments used on these systems are as simple as it is possible to make them.

The systems are designed so that they are simple to install, and the diagrams, as shown here, are plain and complete.

Their No. 2 system is an all-around intercommunicating and selective ringing system. The instruments are of the switchless type, so that they are perfectly automatic and need no adjustment in any way when the receiver is hung up. This instrument has many advantages, it is asserted, over the switch type. It saves consulting a key to find the number of the station that one wishes to call, then

FIG. 1.—MONOPLEX TELEPHONE.

turning the switch to that point and pressing the button. Pressing the button beside the name of the station to be called is all that is necessary with the switchless type.

Another prominent feature is that it can be used for a finder to get a man immediately, no matter where he is in the building. This is done by a code of signals, which are rung on all of the bells at

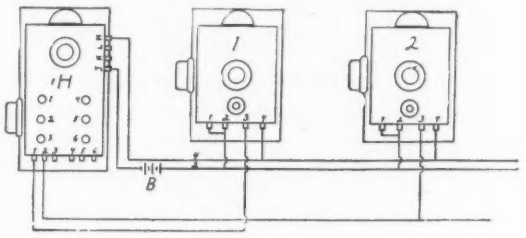


FIG. 2.—DIAGRAM OF CIRCUITS.

one time. The person then, on hearing his signal, goes to the nearest telephone. The number of wires required on this system are three, plus the number of instruments. Hence, a system of say five stations would require three plus five, or eight wires.

Only one central battery is needed for both ringing and talking circuit, and for the ordinary system, three dry cells or four wet cells

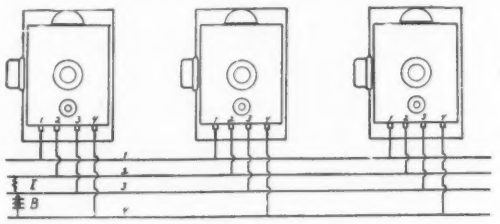


FIG. 3.—DIAGRAM OF CIRCUITS.

are sufficient. The impedance coil necessary with this system is inexpensive, and is as easily connected to the wires as would be a single cell of battery.

System No. 3 is their "Universal Intercommunicating" method.

It is non-selective, but thoroughly intercommunicating. It requires four wires and a single push button at each instrument rings all of the bells on the system. By a code of signals the different stations may be called, or for factory use it is much better for the signals to call the different men required. A central battery of two or three cells is all that is needed.

System No. 4 is a selective ringing non-intercommunicating system. This is to be used where there is a central with several outlying sta-

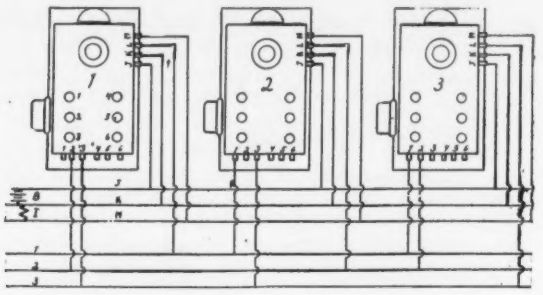


FIG. 4.—MONOPLEX TELEPHONE CIRCUITS.

tions. The station can call up and talk with central and central can call them up individually, but they cannot call up and talk to each other. The number of wires needed is two, plus the number of outlying stations. Thus a system consisting of a central and four outlying instruments would need six wires. If the instruments lie in opposite directions, three wires go to each. The battery is centrally located and no impedance coil is used. The impedance coil used in Systems Nos. 2 and 3 is sealed in a wooden box with heavy leading wires for connecting.

Steam Turbines in the Rockland, N. Y., Central Station.

The Rockland Light & Power Company, of Nyack, N. Y., has for a number of years been engaged in furnishing light and power to the local territory surrounding the town of Orangeburg, N. Y., where the generating station is located. The system covers a territory of considerable extent, embracing the towns of Nyack, Grand View, Piermont, Sparkhill, Orangeburg, Tappan, Blauvelt, Nanuet, Spring Valley and Monsey. The territory will now be covered by five independent distributing systems, each fed by a separate transmission circuit from the power house at Orangeburg. The load consists mainly of incandescent lighting, but motors of considerable capacity are installed at a number of points. The present equipment of the station comprises a number of different types of boilers, engines and generators. The latter are belted outfits, and will be largely replaced by the new steam turbo-generator unit to be installed. The present system is a two-phase, 3,300-volt, alternating-current system, each generator operating independently upon a separate circuit. In the new arrangement provision has been made for operating the entire system from the turbo-generator unit, the remaining machinery being held in reserve for periods of heavy load. The turbine is of the standard single-cylinder, multiple-expansion type, built by the Westinghouse Machine Company, of Pittsburg, Pa., and is of the type that has been installed in other power plants, notably the Westinghouse Air Brake Company, Hartford Electric Light Company, and the Yale & Towne Manufacturing Company, Stamford, Conn. The turbine will be furnished with superheated steam at 125 pounds pressure, this being accomplished by an independent superheater, with which a superheat of 100° to 125° F. will be obtainable. The mechanical equipment includes also a Snow condenser, capable of maintaining a high vacuum, an Alberger cooling tower for cooling the circulating water, and a mechanical draft outfit. The turbo-generator will be of the type recently standardized by the Westinghouse Electric & Manufacturing Company, for this class of service, and will furnish two-phase, 60-cycle current at 3,300 volts, directly to the station bus, from which the several transmission circuits extend in various directions to the local centers of distribution.

Exhibits at the Northwestern Convention.

As usual, a number of parlor exhibits were made at Hotel Pfister during the convention of the Northwestern Electrical Association at Milwaukee, January 21 and 22.

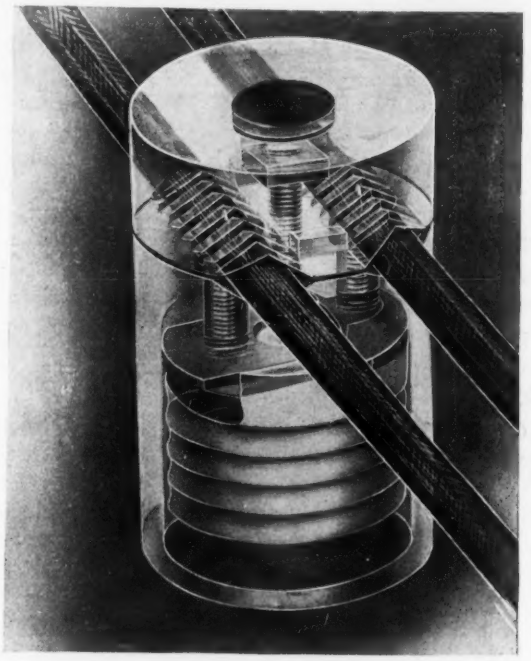
THE GENERAL ELECTRIC COMPANY made no attempt at extensive display, but had headquarters at one of the parlors, and that company's new concentric diffuser for store and factory lighting by arc lamps, which was taken up in Mr. Ryan's lecture on "Light and Illumination," was seen in practical use in the club rooms of the hotel, where the convention was held. These diffusers distribute the light equally over the room, giving a very superior kind of illumination. W. D. Ryan and Mr. Stickney, of Lynn, Mass., and H. C. Wirt, of Schenectady, were the factory contingent in attendance, while J. Scribner, F. N. Boyer, S. F. Dibble and Mr. Beardsley, of Chicago, with Thomas Ferris, of Milwaukee, represented the sales department.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY received visitors and distributed bulletins in one of the parlors and were represented by W. R. Pinckard, A. L. Millard and W. D. McDonald, of Chicago.

THE JANDUS ELECTRIC COMPANY had some of its interchangeable arc lamps burning in the hall on a rack where all parts could be easily inspected. These lamps have parts interchangeable, so that the coils can be changed to adapt the same lamp to various circuits. W. R. Bonham, of Chicago, explained the points of the lamps to delegates and also represented the Buckeye Electric Company.

MR. JOHN A. STEWART, of Cincinnati, received visitors in Room 12 and represented his company, which is doing a fine business throughout the West in second-hand electrical machinery.

THE CROUSE-HINDS ELECTRIC COMPANY, represented by F. F. Skeel, of Chicago, exhibited some of its switches and Norbitt porcelain specialties. The latter, which attracted special attention, consist of a line of wall and ceiling sockets that permit of remarkably safe,



TEMPORARY SOCKET FOR DECORATIVE PURPOSES.

easy and rapid connection to the mains, and sockets also, adapted to rapid connection with stranded wires without cutting and scraping the insulation. The connection in the latter case is made with points forced into the conductor. It is specially intended for rapid stringing of festoons of lamps or other temporary decorative work.

THE ELECTRIC APPLIANCE COMPANY made its presence in Parlor 10, known by numerous original and catching methods of advertising, most notable among which was the "Buttinsky," which was found hanging at frequent intervals around the corridors. Packard transformers, Gutmann wattmeters and Whitney instruments were among the principal exhibits of this company. The core and coils of a Packard transformer immersed in water were shown operating at 1,000 volts, and one of the salesmen was sufficiently devoted to his

company's interests to demonstrate that the 1,000 volts was not a bluff, by putting his hand across the terminals. W. P. Upham, I. A. Bennett and J. B. McMullen represented the Electric Appliance Company; L. Chadwick the New York & Ohio Company, Packard transformers, and C. M. Nevins, the Whitney Electrical Instrument Company.

THE KUHLMANN ELECTRIC COMPANY, represented by Mr. Kuhlmann, exhibited several sizes of Kuhlmann transformers, which are provided with sheet steel riveted cases in place of the usual cast iron.

THE FORT WAYNE ELECTRIC WORKS had a new electrostatic ground detector for high-potential alternating-current circuits on exhibition. The revolving fan motor, which was shown last year for the first time, has enjoyed a great sale the past year, and was again on exhibition practically without modification. This fan is said to take but 16 watts. W. S. Goll, J. H. Raymond and I. S. Jackson were the company's representatives.

THE BRYAN MARSH COMPANY had Geo. C. Keech, of Chicago; L. P. Sawyer and J. L. Barnard, of Minneapolis, receiving delegates at its headquarters.

THE ILLINOIS ELECTRIC COMPANY exhibited a very neat combination socket and shade for incandescent sign and decorative lamps. When desired the tiny porcelain shade can be reversed to cover the socket, making a very neat appearance. A line of cheap service switches was shown. The Peirce bolt for fastening brackets and signs to brick walls with tools for doing the work was also shown. N. G. Harvey and C. W. Bacon were this company's representatives.

VAN RENSSELAER, LANSINGH & COMPANY, agents for the Holophane Glass Company, for Chicago territory, had an exhibit parlor, but the main exhibit was in the lobby of the hotel, where a contract had just been filled for the equipment of all the lamps with holophane globes. The difference in illumination with the holophanes as compared with the old frosted globes was striking, and all the more so when it was learned that 10-cp lamps had replaced 16-cp in all the sockets. V. R. Lansingh was on hand and also C. A. Howe, vice-president of the Holophane Glass Company.

THE CHRISTENSEN ENGINEERING COMPANY, which so recently branched out into the extensive manufacture of electrical machinery, made an exhibit of course. Some of its smaller armatures and a generator were moved from the factory to the hotel for this purpose. S. W. Watkins, president; F. L. Hutchinson, sales manager; Charles D. Knight, engineer, and Mr. Richards, of Milwaukee, with Charles G. Burton, manager of the new Chicago agency, formed the company's representation.

PASS & SEYMOUR.—Their switches, sockets and porcelain specialties were exhibited by John W. Brooks, the Chicago sales agent.

THE DEARBORN DRUG & CHEMICAL WORKS received visitors and gave out barometer cards at one of the parlors. They were represented by P. H. Early, of Milwaukee.

THE OSBORNE-MORGAN COMPANY, of Cleveland, Ohio, is a new company in the arc lamp field. It makes an arc lamp which can be run on either direct or alternating circuits. The coils are the same for both circuits, and the only change when run on alternating circuits is the omission of the resistance coils, which are cut out by a switch on the lamp. P. J. Morgan and Joseph Melzer were in attendance exhibiting the lamp.

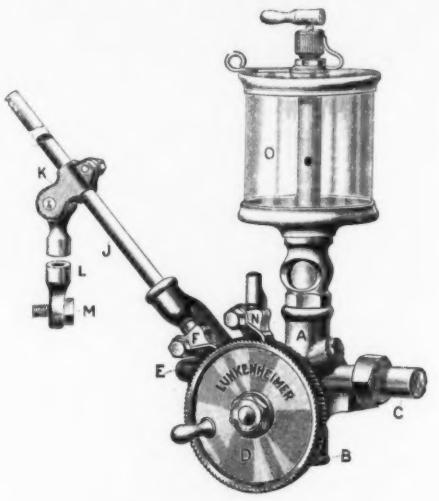
ANDRAE & SONS COMPANY, of Milwaukee, made an exhibit of the various lines of goods handled by them, including Nernst lamps and other Westinghouse apparatus.

THE ELECTRIC STORAGE BATTERY COMPANY invited delegates to visit one of the largest batteries in the world, viz., 608 cells, recently installed by the Milwaukee Electric Railway & Light Company, used either for railway or lighting or both. G. H. Atkin and Otto E. Osthoff did the honors.

OTHER COMPANIES represented at the convention, but not making exhibits were M. B. Austin & Co., A. Meinema; American Circular Loom Company, Thomas G. Grier; Adams Bagnall Electric Company, J. G. Pomeroy; A. M. Barron, consulting engineer; Chicago Insulated Wire Company, William M. Smith; Curtiss-Crippen Engineering Company (De Laval turbine), L. F. Mahler; Columbia Incandescent Lamp Company, W. O. Garrison, James B. Coole; Crescent Soldering Compound, J. H. McGill; Gregory Electric Company, A. O. Kuehmstead and R. H. Watson; G. I. Company, Francis Raymond; Gould Storage Battery Company, E. L. Draffin; Guarantee Electric Company, Charles E. Gregory; Hart & Company; McRoy Clay Works, E. F. Kirkpatrick; Monarch Electric Wire Company, C. A. Kuhlman; Mechanical Appliance Company, T. F. Whitfield; Mechanical Boiler Cleaner Company, W. R. Mason; Minneapolis Steel & Machinery Company, W. B. Kitt; Northern Electrical Manufacturing Company, T. F. Whitfield; New York Insulated Wire Company, James Wolff; Standard Underground Cable Company, J. R. Wiley and E. J. Pietzeker; Sprague Electric Company, Alexander Henderson; Wagner Electric Manufacturing Company, R. J. Russell.

Mechanical Oil Cup.

An ingenious but simple form of mechanical oil cup, herewith illustrated, has been put upon the market by the Lunkenheimer Company, of Cincinnati, Ohio, as the result of the demand for a positive mechanically-operated lubricator, and as the result of considerable study and experimenting to produce a first-class lubricator of this kind. This method is said to be more reliable than that obtained by lubricators hydrostatically operated, and, when properly constructed, the oiling is absolutely positive, and all of the oil fed to the pump is bound to be forced to the steam chest or cylinder of the engine. Referring to the illustration it will be seen that the driving mechanism is of the ratchet type and is operated by the clutches *F* and *N* that work co-operatively by the motion of the



MECHANICAL OIL CUP.

rod *J*, which can be attached to the eccentric rod, or other moving parts of the engine, by the couplings, *K* and *M*. The motion thus obtained is transmitted to the piston, *E*, by the crank-pin mechanism, *H* and *G*. The ratchet wheel, *D*, is provided with a handle whereby it can be rotated by hand in case it is desirable to force a quantity of oil at any time, as, for example, when starting the engine.

By moving the part *K* up or down the rod, the stroke of the pump can be lengthened or shortened, as desired, thus regulating the amount of oil fed by the pump independent of the feed from the oil cup. The joints of the cup are tight, the sight-feed glass being packed so as to prevent the access of air that would have a tendency to cause the cup to feed after the engine had ceased running. This construction and the use of check valves in the pump prevent the oil supply from flooding.

The outlet, *C*, is piped to the steam pipe or chest of the engine, and the spring check valve, *X*, should be placed as near the end of the pipe as possible, preferably into the steam pipe. The bottom of the pump body, *B*, is tapped ½-inch pipe thread to receive a stand so that it can be placed wherever desired. The pump is substantially constructed, the workmanship being first class, and, as the parts are made to jigs and templets, they can all be easily renewed, being perfectly interchangeable. The ratchet wheel, *D*, and pawls, *F* and *N*, are made of tool steel, tempered and hardened. All other metal parts about the pump are made of the very best hard bronze composition.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money was easier throughout the week, closing at 4¾ for all dates up to six months on good mixed collateral. The stock market was dull and featureless, with a sagging tendency in prices, the easing of money having no apparent effect in stimulating interest in the market by outside speculators. The announcement of the decision of the Appellate Court against the validity of the franchise tax law affected temporarily the traction group and other stocks directly involved. The industrials were dull most of the week, although Amalgamated Copper had better support and was fairly active at between 65⅛ and 62¾, but afterwards shared in the general dullness. United States Steel stocks were steady and comparatively featureless. The tractions closed weak with net losses compared with the closing prices of the previous week amounting, in the case of Brooklyn Rapid Transit, to ⅞ point and in the Metropolitan Street Railway to 2¾. The former closed at 67⅜ after having reached 69⅛, and the latter 138¾, the highest price of the week being 142. Manhattan was featureless, closing at 150½, a net loss of 3⅜ points. The market for outside securities closed quiet, with, however, a steady tone. Fractional advances were recorded in Electric Vehicle common and Marconi Wireless of Canada. About 600 shares of the latter changed hands on Saturday at 5⅜ a 5½. De Forest Wireless Telegraph sold at 5¼ a 5⅜ for about 500 shares. In Boston, American Telephone & Telegraph declined 1½ points for the week. Following are the closing quotations of January 27 at New York:

NEW YORK.

	Jan. 20	Jan. 27		Jan. 20.	Jan. 27
American Tel. & Cable	85	86	General Electric	185	191
American Tel. & Tel.	160	162	Hudson River Tel.	..	..
American Dist. Tel.	38	37	Metropolitan St. Ry.	140⅜	138⅛
Brooklyn Rapid Transit	67¼	68	N. E. Elec. Veh. Trus.	..	..
Commercial Cable.	..	..	N. Y. & N. J. Tel.	161⅛	161
Electric Boat	22	23	N. Y. E. V. T. Co.	10 a	10
Electric Boat pfd.	37	30	Tel. & Tel. Co. Am.	..	..
Electric Lead Reduction	3	3	Western Union Tel.	90¼	90
Electric Vehicle	8⅝	7⅜	Westinghouse com.	210	215½
Electric Vehicle pfd.	13½	12⅜	Westinghouse pfd.	210	220*

BOSTON.

	Jan. 20.	Jan. 27		Jan. 20.	Jan. 27
American Tel. & Tel	163¼	162	Western Tel. & Tel. pfd.	101	99½*
Cumberland Telephone	..	..	Mexican Telephone	2⅛	2
Edison Elec. Illum.	.	*277½	New England Telephone	137	135
General Electric	..	192⅛	Westinghouse	103	107
Western Tel. & Tel.	26⅛	24	Westinghouse pfd.	103	108

PHILADELPHIA*

	Jan. 20.	Jan. 27		Jan. 20.	Jan. 27
American Railways	..	..	Phila. Traction	98¼	98¼
Elec. Storage Battery	80*	80½	Phila. Electric	8⅜	8¼
Elec. Storage Battery pfd.	..	..	Pa. Electric Vehicle	..	..
Elec. Co. of America.	9½	9¼	Pa. Electric Vehicle pfd	..	..

CHICAGO.

	Jan. 20.	Jan. 27		Jan. 20	Jan. 27
Central Union Tel.	..	..	National Carbon pfd.	98	98
Chicago Edison	..	165	Northwest Elev. com.	..	..
Chicago City Ry.	230	228	Union Traction	16½	12
Chicago Tel. Co	..	..	Union Traction pfd.	50	45
National Carbon	25	20			

*Askcd.

TOLEDO RAILWAYS & LIGHT.—Mr. Albion E. Lang, chairman of the board of directors of the Toledo Railways & Light Co., in the annual report of the company, says: In view of the improvements in track and equipment made during the year 1902, and provided for 1903, and the enlarged facilities growing out of the construction of the new shops and car houses, it is my opinion that we will earn the current year not less than 3 per cent. on the capital stock of the company. We are now supplying the city with 1,167 street arc lamps, being an increase of 85 over the previous year, and are at present supplying current for 107,663 incandescent lamps and current for 3,271 hp in motors. During the year an extension to the engine room of the power house has been completed, and the large 3,000-5,000-hp engine purchased of Allis Company, and the 2,000-kw Westinghouse direct-connected generator has been installed. Some additions have been made of machines of smaller capacity to strengthen the electric light department. Two large Heine boilers were also installed during the year. The work of installing the McKenzie traveling grate has been continued during the year, and all boilers are now equipped with them except two, which will be installed during the coming summer. Five interurban roads now enter the city under contract with us over our tracks, and a sixth interurban road will enter during the year 1903. The following is a comparative statement of the gross earnings of the present properties owned by the Toledo Railways & Light Company for the years 1897 to 1902, inclusive. It is difficult to show the net earnings of the several properties, owing to the many mergers, consolidations and changes made during this period of the underlying electric light and railway properties:

1897	$897,361
1898	968,516
1899	1,069,279
1900	1,182,516
1901	1,311,084
1902	1,459,091

The increase in gross earnings over the preceding year is 11.29 per cent., as against 10.87 per cent. for 1901 over 1900. The net income for the year shows earnings of 2.27 per cent. on the capital stock of the company.

INTERNATIONAL STEAM PUMP.—The circular to shareholders of the International Steam Pump Company with reference to the issue of debenture bonds recently authorized says that the growth of the business has so far exceeded expectations that it has become necessary to greatly enlarge and concentrate its existing plant and to build new factories to meet the changed conditions and provide for further extensions. The volume of business for the year ended October 31, 1902, is about double the amount of business of the constituent concerns for the year ended at the formation of the company. On October 31, 1902, there were $5,686,067 of orders in hand. The net profits for the three years have averaged 6.95 per cent. on the common stock over and above all fixed charges and contributions to the sinking fund, and after allowing amply for depreciation. A tract of land has been purchased and work begun on a plant at Harrison, N. J., which will be by far the largest pump works in the world. The works of the Snow Company, at Buffalo, are being changed and enlarged with the view of concentrating a large part of the water works business at that point, and the capacity of the Blake factory is also being increased by the erection of a new factory and equipment. For these purposes, as well as to provide funds to pay for improvements already made, for which the company has temporarily borrowed about $700,000, the directors have authorized an issue of $3,500,000 debentures. It is intended to issue not exceeding $2,500,000 of these debentures at this time and then only from time to time as the money is needed. This amount of $2,500,000 has been underwritten at the price to the company of par and interest less one and one-half per cent. (1½ per cent.) commission, subject to the right of the stockholders to subscribe for their proportion of these debentures at par.

CHICAGO TRACTION DEALS.—It is stated from Chicago by one of the committee formed to negotiate terms with the city for a renewal of street car franchises that prior to the formation of that body "strong Eastern interests" in the Union Traction Company pledged themselves to raise $50,000,000, if needed, for improvements. It is understood that this pledge originated with J. Pierpont Morgan, and therefore it is not doubted that the pledge will be made valid when the time arrives for using the money. The same authority says that after the franchises shall have been granted a complete reorganization of the finances of the Union Traction Company will take place. This also would involve the raising of a large amount of new capital. It is proposed in a tentative way to retire most of the underlying securities with a general 4 per cent. bond. Nothing, however, will be done with the old Chicago West Division and North Chicago Railway stocks guaranteed at 35 and 30 per cent. respectively.

THE UNITED GAS & ELECTRIC COMPANY reports results of operations of their constituent companies for the year ending December 31, 1902, as compared with the previous year as follows:

	1902.	1901.	Changes.
Gross	$619,430	$541,844	Inc. $77,586
Expenses	470,892	437,699	Inc. 33,193
Net	$148,538	$104,145	Inc. $44,393

Expense include all cost of operation, insurance, taxes, maintenance and interest on all bonds of sub-companies. From the net earnings of $148,538, the company has paid preferred stock dividends amounting to $64,500. The balance, $84,038, is equal to more than 8 per cent. on the entire outstanding common stock, and is being expended on extensions and betterments.

CENTRAL UNION TELEPHONE.—The Central Union Telephone Company for the year ending December 31 showed gross earnings of $3,003,717; net profits, $180,345. W. S. Chapman replaces Colonel Clowry on the directorate.

AMERICAN DISTRICT TELEGRAPH.—The annual report of the American District Telegraph Company for the year ended December 31 shows a decrease in gross earnings of $14,149, a decrease in operating expenses of $22,368 and a consequent increase in net earnings of $8,219. The total surplus increased $9,981 and the outstanding capital stock remained unchanged at $3,844,700, of which $5,500 is in the treasury. In his annual report President Robert C. Clowry says: The comparison is very favorable, especially in view of the fact that during the first half of the last year the records show a decrease of $17,887 in the net receipts, and that the conditions since have been distinctly unfavorable for a good business. The income account compares with 1901 as follows:

Rev., all sources	$610,043	Dec.	$14,149
Ex., main. and const.	513,176	Dec.	22,368
Net revenue	$96,867	Inc.	$8,219
Dividends	76,886	Dec.	19,221
Surplus	$19,981	Inc.	$27,440
Previous surplus	78,729	Dec.	7,459
Total surplus	$98,710	Inc.	$9,981

NEW YORK CONSOLIDATED GAS.—At the annual meeting of this great concern, President Gawtry said: "The year just ended has been a trying one for the company, the works, both gas and electric, have been run up to their full capacity, and it is a source of congratulation that the company has been able to meet the demands made upon it. The scarcity of fuel caused much anxiety, as at times during the last two or three months the requirements ran up as high as 3,500 tons a day, for which, in most cases, high prices have had to be paid, as all contracts were suspended during the strike. There was imported early in the summer a quantity of Welsh coal, which helped out the situation to a great degree. It was a serious question at one time whether all the supply of gas required could be supplied, some days the consumption running very near 80,000,000 cubic feet." He added that the output of electric current during the year had been 88,500,040 kw, an increase of 18.36 per cent.

MARCONI WIRELESS TELEGRAPH.—The success of Mr. Marconi has renewed interest in the Marconi Wireless Telegraph Company, which controls the patents for the United States. The capital of the company is $6,500,000 and of this stock $1,200,000 was offered to the public at $65 per share. This stock is now $65 bid, and since Mr. Marconi's remarkable success there has been considerable inquiry for the stock. While estimates as to probable earnings of the company are necessarily vague at the present time it is considered within bounds, say the officials, to figure upon net earnings of about $350,000 annually from its transatlantic stations by sending messages at one-half the present rates. The Marconi and Postal companies will work together in the transmission of messages.

MEXICAN LIGHT & POWER.—The Canadian Bank of Commerce, through Senator Cox, of Toronto, and the Bank of Montreal, through Mr. James Ross, president of the Dominion Iron & Steel and Dominion Coal Companies, have subscribed the $12,000,000 worth of stock required for the carrying out of the project of the newly formed Mexican Light & Power Company, Limited. The new company, the entire capital for which has been subscribed in Canada, will supply electric power to the City of Mexico from the Uecaxa River, a distance of 85 miles. Mr. Hugh L. Cooper, of New York, the engineer of the San Paulo project in Brazil, will be engineer of the new Mexican company.

BRISTOL GAS & ELECTRIC COMPANY, of Bristol, Tenn., will receive bids for its 5 per cent first mortgage collateral twenty-year gold bonds at 95 and accrued interest. The total issue is $375,000, of which $220,000 is authorized to be sold. This company is now the owner of all the gas lighting, electric lighting and street railway service of both Bristol, Tenn., and Bristol, Va. Mr. M. F. Dobbins is business manager.

ASSIGNMENT.—The assignment of the Sargent Automatic Signal Company, of Rochester, N. Y., is announced. The company's capital was $1,000,000. Mr. H. C. Rutherford was appointed assignee. The company made electric automatic signals for railways. The reason for the assignment has not been learned, but it is reported that the company's assets consisted almost exclusively of patents.

DETROIT EDISON COMPANY.—The Detroit Edison Company, of New York City, was incorporated at Albany a few days ago with a capital stock of $6,000,000. The directors are Charles W. Wetmore, George R. Sheldon, Edwin M. Bulkley, Charles A. Coffin, William F. White, Alfred Jaretzki, Albert S. Ridley, Henry W. Clark and George H. Olney, of New York City.

DIVIDEND.—The Western Telegraph & Telephone Company has declared a regular semi-annual dividend of $2 a share on the preferred stock, payable February 2 to stock of record January 22. A dividend of $3 per share will be paid on the preferred stock of the Jacksonville Electric Company February 2, 1903, to stockholders of record January 20, 1903.

WIRELESS TELEGRAPH STOCK.—Stocks of the American De Forest Wireless Telegraph Company and the Marconi Wireless Telegraph Company, of Canada, have been added to the list of marketable securities in New York financial circles.

Commercial Intelligence.

THE WEEK IN TRADE.—The reports submitted to the mercantile agencies continue to be favorable, there being further expansion in spring trade, particularly in dry goods. Clothing, shoes, hardware and hardware lumber are active, says *Bradstreet's*, and the volume of shipments of spring goods to fill orders offers still another problem for the congested transportation companies to solve. There is some complaint of the interruption in manufacturing industry by the high price and scarcity of coal at the East; imports of foreign coal are increasing, however. Among manufactured products the strength of iron and steel is notable; and in finished products steel plates, bars and rails are especially strong and active. Numerous orders for cars are coming forward and this has created a large business for miscellaneous steel and for yellow pine. The strength of the building materials market is a notable feature; the outlook for new building operations during the year 1903 shows that there will be much activity. Specially good Western trade reports came from Chicago and in St. Louis spring business is fully equal to expectations. Favorable reports are also received from other widely separated sections of the country. Taking it altogether, the situation could hardly be more favorable to the industries in general. In the metal market copper showed little increase in activity and prices slowly fell off. Various glowing reports of a large copper business were circulated, but these had no apparent effect upon the market. The last quotations were as follows: Lake, 12.15 c. to 12.30c.; electrolytic, 12.5c. to 12.25c.; casting stock, 12c. to 12.12½c., and Standard, 11⅝c. During the week ending January 22 there were 253 business failures according to *Bradstreet's* reports, against 234 the week previous, and 292 the corresponding week last year.

ORDERS FOR TROLLEY APPARATUS.—President H. H. Vreeland, of the Interurban Street Railway Company, has placed an order for 200 large open cars for the Forty-second Street, Manhattanville & St. Nicholas Avenue branch of the Third Avenue line, to be delivered in the near future. Some time ago the company ordered 150 cars for this line, but when they arrived the roadbed was in such condition that they could not be used. Mr. Vreeland said that the Interurban Company will spend $5,000,000 in increasing the facilities in Manhattan by the installation of the sub-surface trolley system on its crosstown lines on Thirty-fourth Street, Fourteenth Street, Grand Street and Fourth Avenue. This work will begin early in March and will be rushed to completion. The rails and other materials for the conduits have been ordered, some of which have already been delivered.

TELEPHONE EXCHANGE CONTRACT.—The local telephone company, Bellevue, Ohio, will shortly close a contract for central office equipment for Norwalk, Ohio. The equipment will consist of multiple switchboard for party line service. Each cord circuit will be equipped with four party selective indicating keys. Equipment will be modern in every detail. The power plant will be operated from a gas engine installed by the company. Specifications for the plant were drawn by LeRoy W. Stanton, consulting telephone engineer, of Cleveland, Ohio.

WIRELESS TELEGRAPHY.—The American De Forest Wireless Telegraph Company has just received a dispatch from Mr. G. Harry Barbour, executive engineer, stating that the wireless tower at Cape Hatteras has been rapidly pushed to completion. A large force of men are at work and expect to open long-distance wireless communication with their station at Block Island, nearly 500 miles away, within 60 days.

INSULATORS FOR MEXICO.—Pass & Seymour, Incorporated, of Solvay, N. Y., through Mr. W. Brewster Hall, 34 Dey Street, has just secured a contract from the export commission house of William E. Peck & Co., 116 Broad Street, New York, for special porcelain insulators for shipment to the City of Mexico.

CATALOGUES, ETC., WANTED IN SPAIN.—La Industria Electrica, 57 Muntaner, Barcelona, Spain, desires to secure catalogues, price lists, with best discounts, of American electrical machinery. The concern is interested in everything pertaining to the equipment of electric plants.

STATUS OF THE COPPER MARKET.—The National Conduit & Cable Company, of New York, in their "Copper Gossip" circular of January 21, says: The copper market is a peculiar one and places us in a position where it is somewhat awkward to act as advisors. Our feelings are that the price of bars should go lower, and yet the various sellers of the same are holding their prices firm. It is hard to get information that is correct in regard to the production and amount of stock on hand of refined copper. The various producers have always either refused information or have given figures which suited their purposes, rather than those which were correct; but from the information that is obtainable, and from comparison with past figures, the stock on hand on January 1, 1903, is said to be over 250,000,000 pounds, being as large as any, if not the largest, ever in the hands of producers. There are also millions of pounds of copper bars which were sold last year to new enterprises, such as the New York Rapid Transit Subway, the Pennsylvania Railroad, the Underground Electric Railways of London, and others; also to the manufacturers of copper products, all of which must be consumed this year and next, before the enormous surplus stock can be called upon. In the meantime, the producers of copper are turning out each month an amount of copper which is largely in excess of the average amount of consumption, and either the consumption must increase, culminate or the production be curtailed, or the producers will have a load which will be impossible for them to carry. As there does not seem to be any uniformity of action among the producers we can only see one result, and that is a continued overproduction, and necessarily enormous interest charges to carry such a stock. If they put the price of copper bars at a figure which will allow it to be consumed in much larger quantities than heretofore, and used for new purposes, they will be able to take care of this overproduction; and by their placing the bars at such prices they will necessarily curtail production by cutting out such producers as are unable to sell at these figures. The record for last year was phenomenal, inasmuch as the copper consumed in this country, exports from this country, and imports into this country, are all record breakers; and yet, notwithstanding the fact that both the consumption and exports were the greatest ever known, the surplus stock was considerably increased. All indications for the year point to a large volume of business, which, we believe, will fully equal that of 1902, but this can only be accomplished by maintaining about the same basis of prices.

THE ST. JOSEPH & ELKHART POWER COMPANY, of Mishawaka, Ind., is installing a large hydraulic plant on the St. Joseph River near Mishawaka, including power house, dam and hydraulic and electric equipment for the generation and transmission of electric power to the cities of South Bend, Mishawaka and Elkhart, Ind., and adjacent territory. The energy will be used for general lighting and power purposes. The consulting engineers and general contractors for the complete development are Messrs. Sanderson & Porter, 31 Nassau Street, New York City, who have recently purchased from the Westinghouse Electric & Manufacturing Company four 1,000-kw, 13,200-volt, revolving-field alternators, and two 125-kw, direct-current exciters. The machines are all to be direct coupled to horizontal shaft water wheels. The engineers have also recently ordered a complete high-tension large capacity switchboard from the Westinghouse Company, including a complete equipment of the latest type of its electrically operated oil-brake switches for operation at 13,200 volts.

STROMBERG-CARLSON TELEPHONE CONTRACTS.—The Stromberg-Carlson Telephone Manufacturing Company, of Chicago, reports the following recent contracts: Shawhaw, Ky., with the Buckeye Construction Company, for a 100 capacity drop switchboard; Scottsville, Ky., with Mr. D. A. Oliver for a 100 capacity drop switchboard; Rudd, Iowa, with Mr. W. A. Eckels for a 50 capacity drop switchboard; Clarington, Iowa, with the Clarington Telephone Company for a 100 capacity drop switchboard; Montrose, Pa., with the Clarington Telephone Company for a 100 capacity drop switchboard, and with the Montrose Telephone Company for a 120 capacity drop switchboard; Havre, Mont., with Mr. E. V. Hauser for a 100 capacity board; Centreville, Ky., with the Buckeye Construction Company, for a 100 capacity drop switchboard; Pleasant Hill, Ill., with the Pike County Telephone Company for a 50 capacity drop switchboard; Elmo, Mo., with the State Line Telephone Company for a 100 capacity drop switchboard.

MORE MOVING STAIRWAYS.—The Manhattan Elevated Railway Company has drawn up plans to install escalators (moving stairways) at its stations at Thirty-third Street and Forty-second Street for both the uptown and the downtown platforms. It is believed that the Railroad Commission recently expressed to the "L" officials the desirability of a better handling of passengers between the stations and the street. The receipts of the uptown station at Sixth Avenue and Twenty-third Street have increased at a greater ratio than at any other station of the system since an escalator was installed there, about two years ago. The contract between the city and the Subway Construction Company provides that where the station platforms are more than thirty feet, either below or above the level of the street, mechanical means of conveyance between the platform and the street must be provided. The Subway Company has accordingly arranged to install similar moving stairways at several of its stations.

THE OHIO BRASS COMPANY has decided to substitute alternating-current power distribution for the direct-current system at present in use in its shops at Mansfield, Ohio, on account of the superior economy of the former. A recent purchase from the Westinghouse Electric & Manufacturing Company comprises a 180-kw, 7,200-alternation, two-phase alternator, a direct-current exciter, switchboard equipment and the following induction motors: Two of 40 hp, four of 30 hp, one of 20 hp, one of 15 hp, and one of 2 hp. This apparatus is to provide increased capacity and to replace the following direct-current machinery: One 75-kw, 125-volt generator, one 35-kw generator, three 40-hp motors, two 25-hp motors, and two 5-hp motors, also a three-panel, direct-current switchboard.

THE CINCINNATI ELECTRIC MOTOR COMPANY is starting the new year with a good business. It has just completed the installation of 31 motors in the *Commercial Tribune* Building, Cincinnati, also equipments for operating the large presses of the *Cincinnati Enquirer* and the *Cincinnati Post*, motors for the Baldwin Piano Company, the Premium Buggy Company, Decatur Ill., and the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. It has also made a large shipment of motors to New York City. A neat bulletin, describing its new Type C multi-polar motor is off the press ready for general distribution.

BALL ENGINE ORDERS.—The La Junta Electric Company, La Junta, Colo., has recently purchased a 250-hp tandem compound engine from the Ball Engine Company, Erie, Pa. The National Transit Company, of Oil City, Pa., has recently purchased a 350-hp direct-connected unit. The Ball Engine Company builds the engine. The Lewis Block, Pittsburg, Pa., will have a large and complete electric plant, consisting of three 350-hp vertical cross compound engines direct connected to Westinghouse generators. The Ball Engine Company, Erie, Pa., will also build these engines.

PROMETHEUS ELECTRIC COMPANY, manufacturing electric heaters, etc., elected the following officers at its annual meeting: President, D. T. Davis; vice-president, J. V. Cole; treasurer, W. B. Symmes, Jr.; secretary, Max Loewenthal. The first three are the directors, with Dr. S. S. Wheeler, Max Osterberg, William Ballin and Herbert Noble. The outlook for the apparatus is reported as excellent and the demand is growing rapidly.

THE ANACONDA COPPER MINING COMPANY is about to put in operation a new 5,000-ton-per-day reduction plant, which will be equipped with electrical apparatus for power distribution. A recent contract with the Westinghouse Electric & Manufacturing Company embraces seven motors of an aggregate of 185 hp, to be added to the present installation of about 30 Westinghouse motors of an aggregate of over 1,000 hp.

WHITEHEAD MACHINERY COMPANY, of Davenport, Iowa, has purchased the entire present power plant of Slater Cotton Company, Pawtucket, R. I. The equipment, which will remain in service four or five weeks, comprises 300, 400 and 750-hp Corliss engines, Babcock and Wilcox boilers, large tubular boilers and usual accessory machinery. The purchasers will, it is understood, offer the property for sale.

HEATING PLANT.—The Birmingham (Ala.) Railway, Light & Power Company has let contract to the American District Steam Company, of Lockport, N. Y., for the erection of a steam heating plant to cost $100,000. The same company has nearly completed its 25-mile electric car line loop, connecting Birmingham and Bessemer, and will soon have it in operation.

THE SUSQUEHANNA IRON & STEEL COMPANY, of Columbia, Pa., is about to install an electric power distribution plant in its mills and has purchased from the Westinghouse Electric & Manufacturing Company a 400-kw, alternating-current generator, one 200-hp induction motor and 300 to 400 horse-power in motors, ranging in size from 50 hp to 20 hp.

ELECTRIC FREIGHT TERMINAL.—A new electric terminal freight railway for the convenience of warehouse concerns between the Pennsylvania terminal, Sixty-fifth Street and the Brooklyn Rapid Transit terminal, Thirty-ninth Street, Brooklyn, will be built at once.

WIRELESS TELEGRAPH FOR CUBA.—At Havana on January 21 the council of secretaries decided to authorize the Marconi Wireless Telegraph Company to establish communication between Cuba and the United States.

General News.

THE TELEPHONE.

SAN FRANCISCO, CALIF.—An employee of the Ralston Mining Company in Placer County was fined for shooting deer in the close season, by a judge thirty miles away, who inflicted the sentence over the telephone.

DENVER, COL.—The Rocky Mountain Bell Telephone Company has begun line building in the Big Horn Country in Wyoming. Lines will be built from Rock Springs to Lander, and from Lost Cabin to Basin City. An exchange is being established at Thermopolis. The company contemplates the extension of its Montana lines through to Denver.

ATLANTA, GA.—The long distance line of the Bell Telephone and Telegraph Company, which is being built from Atlanta to Chattanooga, Tenn., has been completed to a point within 17 miles of Chattanooga.

CARROLLTON, GA.—The Gainesboro Long Distance Telephone Company, of Carrollton, has bought out the local exchange at Cedartown, Ga. An 18-mile connection was recently built to Cedartown.

MACON, GA.—A Daus, of Macon and others have bought the interest of J. E. Smith in the Macon and Dublin Telephone Company. A charter has been applied for, the company to have $6,000 capital. The company owns lines from Dublin to Macon and to Sandersville.

ATLANTA, GA.—The entire plant of the Atlanta Standard Telephone Company will be sold at public auction in that city on February 5, under foreclosure proceedings. No bids under $200,000 will be received. This price, it is stated, is about one-third the actual value of the plant. The conduit system and the line construction are of the best character. This sale offers an excellent opportunity in the telephone field, Atlanta being the representative city of the South and capable of supporting 8,000 telephones.

POCATELLO, IDAHO.—The Bell Telephone Company recently increased its rates 70 per cent. which action has caused a storm of indignation among its subscribers. There is talk of starting an independent system.

YATES CITY, ILL.—The Ideal Telephone Company has increased its capital stock from $2,000 to $3,000.

BUNKER HILL, ILL.—The Bunker Hill Farmers' Mutual Telephone Company has been incorporated; capital, $2,500. The incorporators are J. N. Barnes, H. M. Chaffee and M. M. Brown.

CHICAGO, ILL.—Work of installing its first exchange in Chicago is now under way by the Illinois Telephone and Telegraph Company. The exchange building is located at No. 181 Fifth Avenue. On January 1st, 5,000 automatic switches had been mounted and an additional 5,000 are now going in.

INDIANAPOLIS, IND.—The New Telephone Company has declared 1½ per cent. quarterly dividend payable February 1.

FRANCESVILLE, IND.—The Francesville Telephone Company has again changed ownership and is now under the control of J. T. Graves, of Monon.

AURORA, IND.—The People's Telephone Association, of Indiana, has incorporated with a capital stock of $10,000. The principal office and exchange will be in Aurora. B. L. Kilgore, E. W. Swarthout and G. M. Roberts are the directors.

BEDFORD, IND.—The Bedford Home Telephone Company has been organized and incorporated with a capital stock of $75,000. This company absorbs the local company. Charles Lanz is president.

WABASH, IND.—In order to make extensions and pay up the current debt incurred through the destruction of the plant by fire, the Home Telephone Company, of this city, will issue $20,000 of bonds of which $10,000 will be sold at once.

GREENFIELD, IND.—The Sugar Creek & Warrington Telephone Company, of Hancock County, has been incorporated for the purpose of constructing and operating a rural telephone system. B. F. Reeves, S. E. Shube and others organized the company.

EVANSVILLE, IND.—The Cumberland Telephone Company is reported to have announced to investors in its stock that the company is about to withdraw the service in Evansville. The franchise has expired and the city has brought an injunction suit to force the company to get out of the streets. This announcement, however, is not taken seriously.

TILDEN, IND.—This part of Hendricks County is well provided with farmers' free telephone lines. There is an exchange here, one each at Lizton, Clayton, Hazlewood, Stilesville, Amo, Coatsville and other points, and the farmers of this county do an immense amount of talking over their lines. The tendency is to unite these company lines and seek an entrance into the larger cities. It is predicted that there will be much strife over this ambition of the farmers' lines in the spring.

EVANSVILLE, IND.—If the plans of the city administration are successfully carried out, it will be less than a year before a municipal telephone plant is in operation and every wire of every kind within the fire limits is placed in conduits. The mayor and city attorney spent a week in Chicago recently to complete the arrangements for disposing of stock necessary to insure the success of the scheme. They say they were successful beyond expectation. Supply and construction companies have agreed to help out by taking the remaining required amount of stock. The citizens of Evansville will take $125,000 of the stock and when this is subscribed a franchise will be asked for and then it will only be a question of time until the plant is constructed and installed.

INDIANAPOLIS, IND.—Two bills have been introduced in the Indiana Legislature calculated to interest telephone men to the point of lobbying against their passage. The Senate bill provides that where there is more than one telephone exchange in a town or city, the exchanges shall maintain a trunk line, by which, a subscriber of one exchange may talk to a subscriber on another exchange. A rate of 1 cent a minute is provided for in the bill, three cents being the minimum charge. The House bill is designed to regulate the rates telephone companies may charge for service. Under the bill no company can charge more than $1 a month for a residence telephone or $1.50 a month for a business telephone. The author of the bill says that companies are now discriminating against patrons in certain cities and his bill is designed to correct it.

FAIRFIELD, IA.—The Libertyville Telephone Company, with a capital of $7,000, has been incorporated. Ed. Glotfelty is president.

CLARION, IA.—The Clarion & Northwestern Telephone Company will increase its capital stock from $10,000 to $20,000, to extend its service.

DUNKERTON, IA.—The Farmers' Telephone Company and the Jesup Telephone Company have been consolidated. The line will be extended to Waterloo.

HARLAN, IA.—The Marne & Elkhorn Telephone Company has been incorporated by Walter E. Potts and Alfred Long, of Clay Township, and H. J. Ensden, of Marne, Ia. The capital stock is $100,000.

LOUISBURG, KAN.—The City Council has granted a franchise to the Effingham Telephone Company to put in an exchange here.

CLAY CENTER, KAN.—G. M. Stratton has been granted a telephone franchise at this place. His company will be known as the Home Telephone Company.

LEWISTON, ME.—A telephone company has been organized to establish local telephone service at Swan's Island and to extend a cable to the mainland via Mt. Desert.

BAY CITY, MICH.—The present officers of the Valley Telephone Company were re-elected at the recent annual meeting in Saginaw.

CADILLAC, MICH.—The Citizens' Telephone Company of this city, which recently purchased the Sill exchange, is improving the system. A new switchboard is being installed and the circuits will be changed to metallic. The service numbers 300 now and orders are booked for 200 more telephones. All will be completed April 1.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company, of Grand Rapids, will change its system in that city from the manual to the automatic, and has given the Automatic Electric Company, of Chicago, an order for 5,000 telephones and switches, to be delivered during the spring, as soon as the Citizens' Company has completed its new building. The ultimate capacity of the exchange will be 19,000 stations.

WASECA, MINN.—The stockholders of the Waseca Telephone Company have re-elected the present officers of the company for the ensuing year.

JOPLIN, MO.—A general boycott was declared January 10 against the Home Telephone Company by the Central Labor Union. The boycott is the outcome of the telephone girls' strike, which has been renewed with marked strength. Over 500 telephones are reported to have been ordered out, and many have been disabled by cutting of wires in all parts of the city. The strike is not for higher wages, but is claimed to be an "honor" movement.

BUTTE, MONT.—The operators of the Bell Telephone Company in this city have been granted an increase in wages. The company states that it may be necessary to raise the rates because it thinks that the demand of the operators was unreasonable and that it was forced to grant them owing to the peculiar conditions existing in labor union matters.

LINCOLN, NEB.—The Plattsmouth Telephone Company will ask the Council for a franchise to enter Lincoln.

LINCOLN, NEB.—The Ord Independent Telephone Company, capital $10,000, has been incorporated by Fred Bell, S. E. Bell, H. M. Davis and others.

NORFOLK, NEB.—The Elkhorn Valley Telephone Company has incorporated, with a capital stock of $100,000. The incorporators are G. A. Luikhart, W. K. Bowne, O. O'Neill and I. S. Maha.

HOOPER, NEB.—The stockholders of the Hooper Telephone Company have elected the following officers and directors for the coming year: President, E. O. Spielberg; vice-president, Herman Meyer; secretary, J. Howard Heine; treasurer, T. W. Lyman; manager, M. E. Shipley; directors, Bernard Monnich and M. A. Uehling. The reports show that the company has made a wonderful growth during the past year.

ASHEVILLE, N. C.—The linemen of the Asheville, N. C., Telephone Company, who recently went on a strike, have returned to work.

ELMIRA, N. Y.—The Elmira Telephone Company will soon commence the construction of a telephone line from Elmira to Williamsport.

ALBANY, N. Y.—The Ontario Telephone Company, of Onondaga and Oswego counties, has increased its capital stock from $20,000 to $40,000.

BINGHAMTON, N. Y.—The property of the Binghamton Telephone Company has been transferred to the York State Telephone Company for a consideration of $210,000.

SOUTH CAMBRIDGE, N. Y.—The Easton & South Cambridge Telephone Company, with a capital of $3,000, has been incorporated. Directors: S. Allen, E. H. Borden, and P. D. Ives, of South Easton, N. Y.

BAINBRIDGE, N. Y.—The Bainbridge Telephone Company, of Bainbridge, Chenango County, has incorporated, with a capital of $2,000. The directors are: G. L. Douglass, Christopher Toby and Frank L. Smith, of Bainbridge.

ELMIRA, N. Y.—The Elmira Telephone Company's system has been transferred to the York State Telephone Company, the consideration being $142,000 in capital stock and $72,000 in bonds of the York State Company.

MECHANICSBURG, OHIO.—The Mechanicsburg Telephone Company has increased its capital stock from $25,000 to $35,000.

CHATTANOOGA, TENN.—The independent telephone ordinance has passed the city council and the matter is now with the board of aldermen.

SALT LAKE CITY, UTAH.—The Bell Telephone Company will extend its lines from Beaver to St. George, Utah.

LOGAN, UTAH.—Mr. S. F. Fenton is trying to get a franchise in this place for a local telephone company. The Bell interests are opposing the effort.

ELECTRIC LIGHT AND POWER.

WILLIMANTIC, CONN.—The Willimantic Gas & Electric Light Company has practically completed its new coal gas plant, and is now making extensive improvements in the electrical plant. The additions represent about $130,000 of expenditure.

VALDOSTA, GA.—The city of Valdosta has rescinded its action to establish a municipal light plant and has accepted a bid of $75 per light per year from the Valdosta Light and Manufacturing Company. The contract is for five years.

BEDFORD, IA.—The electric lighting business at Bedford, conducted under the name of the Bedford Electric Light & Power Company, C. Wilbur Wiley, proprietor, has been sold and will henceforth be conducted by the Bedford Light, Heat & Power Company, which is a stock company with $20,000 capital.

EAST ST. LOUIS, ILL.—The Citizens' Electric Light and Power Company, of East St. Louis, has increased its capital stock from $25,000 to $250,000.

INDIANAPOLIS, IND.—Returns are beginning to come in from towns which invested in municipal plants built to be traded off. A number of Indiana towns have received hard bumps. The bonds are held by investors and the plants need new engines and dynamos before illumination can be renewed. On top of all this many of these towns have an empty treasury. There is a fear that many Indiana towns will have similiar trouble with these cheaply constructed plants.

LEBANON, KY.—The new city lighting plant at Lebanon has been put in operation.

DELTA, MISS.—The Delta Electric Light & Power Company has increased its capital stock from $50,000 to $100,000.

GRAND RAPIDS, MICH.—The Thornapple Electric Company has elected the following officers: S. D. Kopf, president and manager; Howard A. Thornton, vice-president; Wesley W. Hyde, secretary and treasurer. These officers constitute the board of trustees.

CADILLAC, MICH.—The Cummer Electric Light Company is installing a large generator in its plant and will furnish electricity for power. Six large manufacturing institutions are installing motors to run their plants.

SPRINGFIELD, MASS.—Additional equipment for the municipal electric light plant is being advertised for. The equipment will include two 350-kw generators, two or three-phase; 400 enclosed arc lamps and 150 alternating current arcs.

DULUTH, MINN.—The Great Northern Power Company, of Duluth, has been incorporated with a capital of $100,000. The company proposes to develop hydraulic power. The incorporators are F. A. Cokefair, E. C. Bacot, C. C. Kritzer, E. P. Duffies and Wm. Harrison.

MOUNTAIN GROVE, MO.—A proposition to grant an electric light franchise to the Ozark Cold Storage Company, which proposes to light the city of Mountain Grove with electric lights, will be voted on here.

NEW YORK, N. Y.—The Lehigh Light & Power Company, with a capital stock of $200,000, has been incorporated under the laws of New Jersey. The company will engage in the manufacture of electricity for light, heat, etc. The incorporators are William F. Eidell, Joseph F. Cotter and John A. McPeak, Camden, N. J.

BINGHAMTON, N. Y.—The stockholders of the Binghamton Light, Heat & Power Company have elected the following-named directors; George W. Dunn, Thomas L. Waters, F. W. Jenkins, C. F. Hotchkiss, George F. O'Neil, Chauncey Eldridge, George F. Johnson, T. M. R. Meikleham and W. B. Dinsmore, Jr. The board of directors elected the following officers: President, George W. Dunn; vice-president, Thomas L. Waters; treasurer, W. B. Dinsmore, Jr.; secretary and attorney, F. W. Jenkins. The company is pushing the work at the station as fast as possible. It will be some time yet before the machinery is installed, but when it is finished it will be one of the most complete plants in the country.

COLUMBUS, OHIO.—The Council Committee on Finance has approved the ordinance authorizing an issue of $122,000 bonds with which to erect and maintain a municipal electric lighting plant. The ordinance will undoubtedly pass and bids for the construction of the plant will be called for as soon as possible thereafter.

YORK, PA.—The Ambridge Light, Heat & Power Company, of Ambridge, Beaver County, has been incorporated with a capital of $1,000.

YORK, PA.—The Merchants' Electric Light, Heat and Power Company has elected the following named directors: Charles H. Bear, George C. Campbell, Harry Wasbers, W. L. Bear, Albert Faulk, Thomas B. Loucks, J. A. Walker. The board organized by electing Charles H. Bear, president; George C. Campbell, vice-president; Thomas B. Loucks, secretary; Harry Wasbers, treasurer; Harry Reichard, superintendent.

LEWISBURG, TENN.—The town of Lewisburg has contracted with the Braid Electric Light Company for $5,000 electric light plant. Lighting bonds were issued.

SPRINGVILLE, UTAH.—The city authorities are considering a proposition to bond the city for an electric light plant.

SALT LAKE CITY, UTAH.—The Kennebec Mining Company, of this city, will install an electric power plant this spring. Mr. W. J. Craige is manager.

ATLANTIC CITY, WYO.—The Dexter Mining & Development Company at this place is arranging to put in an electric light and power plant.

THE ELECTRIC RAILWAY.

DOVER, DEL.—The Keystone Electric Railway Company, of Wilmington, has been incorporated with a capital stock of $10,000.

NEW CASTLE, IND.—Estimates are being made for the construction of the Muncie-Newcastle electric railway. Coulter Bros., of Chicago, will finance and build the road.

NEW CASTLE, IND.—A second election is to be held in Harrison Township to vote on a subsidy for the New Castle-Pendleton line. The amount asked has been reduced from $16,500 to $10,000. In the previous election the subsidy was defeated by a small margin.

LAPORTE, IND.—A company is being organized to be known as the Logansport & Laporte Electric Railway Company, to construct a line from this city to Logansport by way of Winona, Twenty Knox, Logansport and Laporte.

KOKOMO, IND.—A company has been organized here to construct an electric railway to connect the cities of Kokomo, Marion and Wabash. Applications for franchises have been filed with the commissioners of the three counties. The promoters are G. W. Dukes, O. V. Darby, and T. C. McReynolds.

MARION, IND.—The Union Traction Company has bought ground in this city and will begin at once the erection of a modern freight depot. The County Commissioners have granted a franchise to the Bundy-Clark Electric Company, of this city, to build an electric line through the county from this city to Kokomo.

PLAINFIELD, IND.—The owners of the Indianapolis and Plainfield Traction line are asking the tax-payers of Center Township, Hendricks County to vote a two per cent. subsidy for an extenison of the line from Plainfield to Danville. The subsidy would amount to $48,000. The company is already under $5,000 bond to have the line completed by December, 1903, and this, it is thought, will encourage opposition to the subsidy.

LOUISVILLE, KY.—The Louisville & Interurban Railway Company, with a capital of $500,000, has been organized to build interurban railways. The Louisville Railway is the owner.

NEW ORLEANS, LA.—The New Orleans Railway Company has filed a mortgage in favor of the New York Security and Trust Company pledging the properties of the various street railways to secure a $40,000,000 gold 4½ per cent. bond issue. The trust company will issue bonds to the extent of $7,154,000 whenever they are needed for improvements.

LANSING, MICH.—Right of way has been secured for the electric railway to be built from Lansing to Pine Lake by the Hawks-Angus syndicate.

OTSEGO, MICH.—The Chicago & Grand Rapids Railway Company has secured a franchise through Otsego. W. H. Patterson is president.

NORTON, MASS.—The Norton & Taunton Street Railway Company will, as soon as the weather will permit, begin building a line through East Norton to connect with the Mansfield & Easton line, now operated by this company.

BOSTON, MASS.—It is stated that a plan is on foot to connect Boston and New York by trolley. The route will be completed, it is thought, in about three years. A high-speed line is contemplated, and the ride from Boston to New York will take ten hours. Dining and sleeping cars will be introduced. Fares will be reduced less than one-half of steam rate. The project is but the first step in the ambitious interurban trolley system down the coast to Washington. Rights of way have been secured for the lines from Worcester to Hartford and Providence, and charters will be sought from the Connecticut and Rhode Island legislatures this winter.

DURHAM, N. C.—The Durham Traction Company has given notice of application to be made for a charter to build an electric railway to Chapel Hill, 15 miles distant.

ALBANY, N. Y.—The Fonda, Johnstown & Gloversville Railroad Company has received the approval of the State Board of Railroad Commissioners for a proposed issue of $7,000,000 first mortgage and an increase in its capital stock from $1,950,000 to $2,500,000.

ALBANY, N. Y.—The Bush Terminal Railroad Company of Brooklyn has been incorporated, with a capital of $15,000, to construct and operate a street surface railway a distance of 1¼ miles in Brooklyn. The directors are Irving T. Bush, Frederick B. Studwell, Herbert Boughton, Henry Greene, Thomas C. Horton, Arthur Carter, A. Brodie, R. Gould Simonds and Joseph Nash, of New York City.

LEECHBURG, PA.—The Pittsburg & Allegheny Valley Railroad Company has closed the purchase of four big electric light plants of this district and the franchise of the Leechburg & Apollo Street Railway Company. The plants of the Parnassus Electric Light & Power Company, the Leechburg Electric Light & Power Company, the New Kensington Electric Light & Heat Company, and the Apollo Light, Heat & Power Company have been purchased. The street railway will be built from Apollo to Vandergrift, to Leechburg, to Braeburn, to Arnold, New Kensington and Parnassus, a distance of 20 miles, and will connect with the Pittsburg Railways Company. The company has a capital of $1,500,000 and is organized by John Q. Cochrane, Pittsburg, president; Dr. J. D. Orr, Leechburg, vice-president; J. J. Burke, Pittsburg, secretary. Leechburg and Vandergrift bankers, with Hon. T. J. Ford and W. T. Marshall and J. R. Cavanaugh, of Pittsburg, make up the directory.

ROANOKE, VA.—The Roanoke Railroad & Electric Company, capitalized at $690,000, has been sold to Philadelphia capitalists. Twenty miles of track are included in the purchase. The new officers are: President, A. R. Apperson, Lynchburg, Va.; vice-president, Charles R. Miller, Philadelphia; secretary-treasurer, F. H. Shelton, Philadelphia; general manager, J. W. Hancock, Roanoke, Va.

CLARKESBURG, W. VA.—H. B. McKinley has organized a company to build an electric railway from Salem to Adamsville. The capital stock will be $300,000.

PORTLAND, ME.—The New England Street Car Transportation Company has been organized at Portland, to carry on a general transportation business. The capital stock is $100,000. The promoters are John E. Warren, Lyman C. Fowler, Thomas M. Foley, all of Portland. Lyman E. Fowler is president and John E. Warren is treasurer.

EAST ORANGE, N. J.—The Mansfield & Eastern Traction Company has been incorporated here, capital $500,000. Incorporators: Charles Meily, James J. Maguire, James W. Galbraith and William J. Pentz.

JERSEY CITY, N. J.—State Senator E. W. Wakelee, of Bergen County, has been appointed Receiver of the Newark & Hackensack Railroad Company, which operates a trolley line between the two points named. The receiver was appointed on the petition of bondholders because the company has failed to pay interest due.

NEW BRUNSWICK, N. J.—The Elizabethport, Amboy & Long Branch Railway Company has been incorporated here, with $500,000 capital stock. It proposes to build a trolley line connecting the three towns. The incorporators are: Edwin Furman, of Sayville; W. Parker Runyon, of Perth Amboy, and Andrew Kirkpatrick, of Newark.

SPRINGFIELD, OHIO.—The Springfield Railway Company is installing in its power house a 450-hp engine and a 300-kw generator, which about doubles the capacity of the plant.

COLUMBUS, OHIO.—The contract for building the extension of the Columbus, Buckeye Lake & Newark Traction Company's line from Newark to Zanesville, has been placed with A. E. Appleyard, of Boston.

MONTPELIER, OHIO.—F. E. Seagrave, of the Toledo & Western Railway, is securing right of way for an extension from the present terminus at Fayette, to West Union, Montpelier, Edgerton, Butler and on into Indiana.

COLUMBUS, OHIO.—The Kenton & Southern Railway Company has been incorporated with a capital stock of $600,000. The incorporators are Richard Emory, Emmett Thompkins, Frank W. Merrick, E. E. Bartman and J. A. Godown. The company proposes to build from Kenton to Bellefontaine and the road will be an extension of the Urbana, Bellefontaine & Northern Railway. Eventually the system is to reach Toledo.

CLEVELAND, OHIO.—The directors of the Lake Shore Electric Railway met with the representatives of the American Trust Bankers' Syndicate, which had contracted to buy part of the new 5 per cent. bonds to be issued, and the plan submitted by the bankers was formally approved. A meeting of stockholders has been called for February 12 to approve the financing plan.

CINCINNATI, OHIO.—The Miami & Erie Terminal Railway Company has been incorporated with a nominal capital of $10,000. T. N. Fordyce, one of the prime movers of the canal project, is one of the incorporators. The ostensible purpose is to afford a means of hauling freight from the Ohio River to the terminus of the canal, a distance of about a mile. Coal and freight will be transferred to barges on the canal and hauled up the valley by means of electric towing motors.

COLUMBUS, OHIO.—At the recent annual meeting of the Columbus Railway Company the stockholders authorized a number of important improvements to the property. The power facilities will be largely increased, a new barn will be built, extensions to several of the lines will be built and the system will be brought up to the highest standard of efficiency. To secure funds for this work the directors were authorized to issue 5,000 shares of preferred stock now held in the treasury, and the proceeds will be used for the improvements.

BOWLING GREEN, OHIO.—The Lake Erie, Bowling Green & Napoleon Railway Company has increased its capital stock from $500,000 to $1,000,000. Officers were elected as follows at the recent meeting: W. M. Tuller, president; F. W. Rogers, vice-president; E. M. McKnight, general manager. The above with R. A. Beatty, M. L. Case, A. Forney, B. F. James, Morris Reese, L. Black, C. R. Painter, J. H. Whitehead and D. B. Whipple are directors. The company has decided to commence work at once on an extension from Pemberville to Port Clinton and from Bowling Green to Defiance.

STEUBENVILLE, OHIO.—The power plant of the Steubenville Traction & Light Company was destroyed by fire recently. The roof fell in and all of the equipment was badly damaged. The loss to machinery and building is estimated at $65,000. The company supplied lights as well as electric railway service and both utilities were tied up for a time. Arrangements were made with the Steubenville, Mingo & Ohio Valley Traction Company for power sufficient to operate the city cars.

COLUMBUS, OHIO.—The Bellaire, Zanesville & Cincinnati Railroad, a narrow gauge steam road operating from Zanesville to Bellaire, has passed into the hands of the Appleyard syndicate. The name of the road has been changed to the Ohio River & Western. New officers were elected as follows: A. E. Appleyard, Boston, president; Richard Emory, Columbus, vice-president and general manager, W. R. Pomerene, Coshocton, secretary, W. R. Mitchell, Boston, treasurer. The above with C. A. Alderman, Springfield, W. V. Baker, Columbus, H. E. Montgomery, Boston, F. S. Hambleton, Baltimore, W. C. Mooney, Woodsfield, and Frank Brandon, Lebanon, are directors. Receiver J. K. Geddes will remain in charge of the property for the present and will be retained in some official capacity. The headquarters will be removed from Woodsfield to Zanesville. The road will be changed to standard gauge and will be operated by electric power, probably with the third rail system. The capital stock of the company was increased from $1,300,000 to $2,700,000.

CHATTANOOGA, TENN.—Franchises have been introduced in the city council for right of way for the proposed Cleveland and Ducktown Electric Railway, projected by S. W. Divine and others. The company proposes to get its power from a waterfall on Coosa River.

MONTPELIER, VT.—The strike which has hampered the Montpelier and Barre Traction Company since the new year came in has been settled. The employes who have been with the company longer than six months are to receive 16 cents per hour and the new men $10.50 per week, the working day to be ten hours.

THE AUTOMOBILE.

BRAZIL, IND.—Capitalists of this city and of Poland are negotiating with a Chicago automobile manufacturer for the purchase of a twelve-passenger motor-car and an express motor-car to put in service between this city and Poland, fourteen miles. The Terre Haute Electric Company promised to build an electric railway between the two cities but it has failed to materialize, hence the movement to establish an automobile line.

NEW INDUSTRIAL COMPANIES.

THE CHICAGO BATTERY COMPANY has been incorporated at Chicago, Ill., with a capital stock of $50,000, by W. R. Gibbs, Wm. Buckley and T. J. Behen.

THE CALHOUN FALLS INVESTMENT COMPANY has been formed at Anderson S. C., by W. F. Cox and others to develop Calhoun Falls. The capital is $30,000.

THE MECHANICAL ELECTRIC COMPANY, New York, has been incorporated with a capital stock of $10,000. The directors are: Francis Lewis, P. M. Randall and Gaetano Damato, of New York.

THE PERFECT TELEPHONE DISINFECTOR COMPANY has been incorporated at Buffalo, N. Y., with a capital of $4,000. The directors are: H. D. Tatem, Lillie H. Tatem, of Buffalo, and Wm. Brennan, of Sloan.

THE MULTIPLE SPEED AND TRACTION COMPANY has been formed in New York City to operate a moving sidewalk in a subway from Hanover Square to the Brooklyn terminus of the new Williamsburg bridge.

THE HOLLAND PALACE CAR COMPANY, of Indianapolis, Ind., has incorporated with a capital stock of $1,000,000. The company will establish a plant in Indianapolis and manufacture cars for steam and electric railways. The incorporators are: H. F. Holland, W. R. Myer, J. W. Selvage and A. L. Wheeler.

LEGAL.

FRANCHISE TAX.—The New York State franchise tax has been found unconstitutional by the Court of Appeals. This relieves lighting, trolley, telegraph and telephone companies from a heavy burden—on top of all their other taxes.

THE NAME OF EDISON.—In the federal district court at Wilmington Thomas A. Edison has filed a bill in equity against the Thomas A. Edison, Jr., Chemical Co., of 14 Stone Street, New York. The bill prays for injunction to restrain the defendants from using the name Edison in connection with part of the corporate title, and the word "Wizard" used in the manufacture of ink tablets sold by the defendant company.

LAMP SOCKET LITIGATION.—A decision has just been handed down by Judge Ray in the suit brought by the General Electric Company, against J. B. Wise, of Watertown, N. Y., on the Tournier patent, No. 559,232, April 28th, 1896, for an incandescent lamp socket, declaring that the patent is valid and infringed by the defendant's device which is an Edison-type lamp socket. An order for an injunction has been issued restraining the defendant from manufacturing any more such sockets.

RIGHTS OF STOCKHOLDERS.—On Feb. 2 in Atlanta a case will be heard to determine the rights of stockholders in a bill of intervention ancillary to an original petition in the case of the City Trust and Safe Deposit Company, of Philadelphia, vs. the Atlanta Standard Telephone Company. A decree of foreclosure was granted some weeks ago ordering the property of the Standard Telephone Company sold at an upset price of $200,000, subject to the rights of the stockholders. The present hearing is to determine these rights.

PERSONAL.

MR. CHARLES T. YERKES has sailed for England again in connection with work on his London transportation enterprises.

MR. JOHN LEO LIVERS, electrical engineer of Martinsburg, W. Va., was married on January 20, in that city, to Miss Olive Mae, daughter of Mr. and Mrs. W. W. Logan.

MR. F. D. LAWRENCE, president of the Standard Electrical Manufacturing Company, of Cincinnati, O., visited New York this week. He reports business in very satisfactory condition.

MR. WILFRID BLAYDES, private secretary to Mr. Marconi, has been slightly indisposed since his arrival in New York City from Cape Cod, but recovered sufficiently during the week to sail for Italy.

MR. LEROY W. STANTON, consulting telephone engineer, of Cleveland, O., has been with the representatives of three or four telephone companies in Chicago during the present week, selecting telephone apparatus for their exchanges.

MR. ANDREW CARNEGIE.—Dispatches from Edinburgh announce that in furtherance of his educational scheme for Scotland Andrew Carnegie has decided to endow a trust for scientific research. The sum of $5,000,000 will be expended on the scheme.

MR. CARL L. DE MURALT has arrived at New York on another visit of several months to the United States. On a previous visit Mr. de Muralt read an interesting paper before the American Institute of Electrical Engineers on the polyphase railways of Europe.

MR. W. A. VAIL, special representative of the American Bell Telephone Company, with headquarters in Indianapolis, Ind., and well known in the East, has been made general manager of the Northwestern Telephone Company, controlling Minnesota and two Dakotas' lines. Mr. Vail's headquarters will be in Minneapolis.

MR. B. C. WASHINGTON, JR., for many years the efficient Washington correspondent of ELECTRICAL WORLD AND ENGINEER was in New York last week attending the automobile show. He has made a great success of the kindred show at the National Capital and has found a profitable field of new effort in connection with automobilism.

MR. JOSEPH B. BAKER, of Boston, who as a consulting electrical engineer has for some time past given his attention to telephony and particularly to automatic systems, visited New York last week to participate in the Institute telephone meeting and to renew many old acquaintanceships. Mr. Baker is an occasional contributor to these columns.

MR. A. J. CORRIVEAU, of Montreal, well known on account of his electric lighting and electric railway interests, has been visiting New York City in order to attend the annual Automobile Show. He is now engaged also in automobile work and is desirous of having a good show held in Montreal, with the object of stimulating interest in the subject generally in Canada.

MR. LOUIS J. MAGEE, the well known electrical engineer, who has now been some thirteen years in Germany at the head of the technical staff of the Union Elektricitats Gesellschaft, has a most interesting article in the February *World's Work*, on "German Business Methods." It abounds in shrewd observation, kindly appreciative comment, and instructive deduction.

MR. W. H. CUMMINGS, of London, formerly European manager of the American Vitrified Conduit Company, 170 Broadway, New York, and who has also acted as manager of the British electrical engineering and contracting firm of Maguire & Baucus, is now on a visit to the United States. Mr. Cummings represents various American electrical interests in Europe. He is a guest at the Hotel Imperial, New York.

MR. SELIM CHAKER, of Cairo, Egypt, who has been in the United States for the past six months, sailed for Europe last Saturday. While here he made arrangements to represent various American concerns in Egypt, Soudan, Syria and Palestine, and shortly after his arrival in Egypt he expects to send over some substantial contracts for electrical goods. Mr. Chaker, according to present arrangements, will return here December next.

MR. F. T. F. LOVEJOY, the young Pittsburg millionaire, whose interest in automobiling was the outgrowth of the purchase of over twenty expensive automobiles within four years is constructing in Pittsburg the finest automobile stable in the country at an expense of $175,000. It will be 180 feet by 75 feet and two stories in height, fitted with large storage rooms, a billiard-room, swimming bath and a gymnasium for the young sons of the millionaire. A tunnel will lead from the stable to the residence now being constructed. An electric plant in the stable will generate the power for lighting the stable and house. Mr. Lovejoy is thirty-five years of age, modest and quiet in his manner, and in appearance hardly the man of $25,000,000, which is the estimate of his wealth—gathered as a member of the Carnegie Steel Company.

SIR HIRAM MAXIM, the American inventor, so long domiciled in England, has postponed his visit to St. Louis and the Louisiana Purchase Exposition Commission until next summer. He has written to the Commission, expressing his interest in the proposed aeronautical exhibition, and offering to send to it his light steam engine constructed for aeronautical purposes, which, he says, however, has been supplanted by the petroleum motors. He does not think that the flying-machine problem has been solved, and does not know whether he will himself attack the question again.

Trade Notes.

PHOSPHOR-BRONZE.—The Phosphor-Bronze & Smelting Company, 2200 Washington Avenue, Philadelphia, Pa., has issued a circular letter and revised price-list No. 21 of its "Elephant Brand" phosphor-bronze.

RIEDLER ENGINES.—Catalogue No. 104 of the Allis-Chalmers Company, Chicago, Ill., which contains 180 pages, is devoted entirely to a partial list of users of Riedler pumping, compressing and blowing engines, manufactured by this company.

THE BURT MANUFACTURING COMPANY, of Akron, O., reports that the Pittsburg Reduction Company has just placed an order with it for a 90-gallon oil filter; also an 18-inch exhaust head, to be used in its new works at East St. Louis, Ill.

THE STANDARD TOOL COMPANY, Cleveland, Ohio, has issued a neat calendar for 1903. The figures are plain and distinct, and no weariness is imposed upon the eye in looking up dates. On the back are given several tables useful to machinists.

FUEL OIL.—The increasing use of oil as fuel for steam generation gives interest to the handsome pamphlet issued recently by the Petroleum Iron Works Company, Washington, Pa. Much information on this interesting subject is published, together with illustrations of boilers equipped with oil-burning apparatus, and of details.

WATER-TUBE BOILERS.—Almy sectional water-tube boilers constitute the subject of a well-illustrated catalogue issued by the Almy Water-Tube Boiler Company, Providence, R. I. The merits of the boiler are clearly pointed out and various illustrations show the constructional details of this type of steam generator, which is adapted to all kinds of stationary work and marine work.

NOXEM RECEIVERS.—In Duluth a short time ago a patron who was using a telephone received a shock through the exposed metal parts of the receiver, which resulted fatally. The Electric Appliance Company, Chicago, claims that its Noxem receiver is an absolute safeguard against an accident of this kind, as it has no exposed metal parts. Its Noxem circular fully describes this new receiver.

DIXON'S GRAPHITE.—"A Toot for Dixon's Graphite" is given in a neatly designed booklet just brought out by the Joseph Dixon Crucible Company, Jersey City, N. J. Graphite as a lubricant is used in many forms and for many purposes, and the advantages in each case are duly "tooted." The cover of the booklet is a light blue which matches very well with the bright red margins of the white pages—the national colors.

RICHARDSON AUTOMATIC SCALE.—The Richardson Scale Company, Park Row Building, New York, has just issued a neat catalogue illustrative and descriptive of its line of automatic weighing machinery. It shows several of the different styles of scale made by this company and includes a number of illustrations made from photographs of the scales in actual use. An illustrated description of an automatic scale for coal was printed in our last issue.

AYER CALENDAR.—Messrs.—N. W. Ayer & Son, Philadelphia, Pa., have gotten out a handsome calendar for 1903. This firm marks each new year by getting up a calendar that surpasses all its predecessors for artistic merit and beauty. The firm charges 25 cents each for the calendar, because it cannot undertake to supply the demand that would follow free distribution. A little pamphlet just issued by the firm tells briefly about its newspaper advertising business.

BOOSTER SYSTEMS.—The Gould Storage Battery Company, 25 West 33rd Street, New York City, recently issued a bulletin devoted to the subject of "Boosters." Shunt, constant-current and differential boosters are illustrated, together with views of Gould storage battery plants. The various features of Gould boosters and battery plants and their wide application are pointed out in the text. Everyone interested in storage battery applications will find this bulletin interesting.

TURRET LATHES.—The Pratt & Whitney Company, Hartford, Conn., has just issued an interesting pamphlet on its new model turret lathes. Improvements incorporated in these machines make possible greater accuracy, capacity, convenience and durability in the production of work. Two sizes are illustrated and many views of details are shown, together with diagrams. The text is printed in two colors, black and red, the red being used for the subject headings of the various descriptions.

CRESCENT SOLDERING SPIRITS.—The Crescent Electric Company, Chicago, Ill., has brought out a useful article for electric wiremen in a form which is very convenient. It is called soldering spirits, and consists of a solution of gums and extracts in alcohol. It is stated to be especially adapted for fine instrument work, telephones, switchboards and magnet coils. It contains no metal or salts and will not corrode the finest magnet wire. It is useful as an insulation, as well as a flux.

THE YOST ELECTRIC MANUFACTURING COMPANY, of Toledo, Ohio, whose incorporation with a capital of $75,000 was recently noted in these columns, is manufacturing the "Yost" key socket, which possesses several commendable features. The mechanism is entirely enclosed in a porcelain casing, giving the necessary insulation by thickness of the porcelain between the mechanical parts, and making it as nearly dust-proof as possible, besides being impervious to dampness. The company succeeded the Yost-Miller Company. Besides the key socket, it manufactures electrical and mechanical appliances and novelties.

A REMINDER OF THE BOSTON TEA-PARTY.—The Pettingell-Andrews Company, in a neat folding card, calls attention to the interesting fact that its new building stands on the site of the Boston Tea Party. On the building is a bronze tablet illustrating and commemorating this great historical event. An illustration of this tablet, together with one of the building, is given in the folder. The new building, according to this source of information, contains 70,000 square feet, and the stock of electrical goods it contains is claimed to be the largest of any electrical supply house in the United States. The company has a modern equipment and every facility for the execution of orders with dispatch.

A FREIGHT TRAIN EVERY SIX MINUTES.—The passenger travel on the New York Central has been exceedingly heavy of late, most through trains being run in sections; and a large amount of extra power has been required to keep mail and passenger trains going. The extreme weather conditions resulted in some congestion of freight traffic, but within five days the New York Central recovered itself and reached normal condition in freight operation. There have been moved recently 7,000 cars per day on the Western Division; and in one day recently out of the Dewitt yard the freight trains averaged one every six minutes. There are moved every day on the New York Central over 980 passenger trains, and from 22,000 to 25,000 freight cars, the daily freight movement being close to 550 frieght trains. When the weather conditions are good, this enormous traffic is readily handled by a perfect and well organized system of management; but during severe storms attended by zero weather the full energy of the thousands of officials and employees must be devoted to keeping the road open for traffic.

MARIS CRANES.—Under the title "Cranes," Messrs. Maris Brothers, Philadelphia, Pa., have issued a very handsome booklet, which tells briefly what this firm is doing in the interest of economical operation of manufacturing plants. It manufactures hand and electric traveling cranes, the principal advantage of which is the small amount of head room necessary for operation; another very important advantage is the ease and precision with which they are controlled by one man, from the floor. The firm claims that by installing one of their cranes ahead of other machinery and equipment it pays for itself before the plant is in operation, and is run practically without expense after that time. The booklet is of unique design, the cover having three folds. The cover is of dark slate color, on which the firm name, fancy designs, views of plants, etc., are printed in bright green and red colors, the chromatic combination being a very attractive and pleasing one. The booklet contains illustrations showing actual installations of these cranes. Cranes are quite indispensable to a modern electrical plant and the managers of such will be interested in the information contained in this booklet, a copy of which the firm will gladly furnish to anyone interested.

THE SURGERY OF LIGHT.—Four writers in the February *McClure's Magazine*, under the general title, "The Surgery of Light," have joined to contribute a welcome discussion of an interesting subject. It was as long ago as 1895, that Dr. Neils Finsen, of Copenhagen, by his light treatment, effected the first absolute cure of that terrible disease, lupus. Yet, even to-day, little has been heard of the cure in this country, though its efficiency is said to be established all over Europe. Of the four contributors to the McClure symposium, Jacob A. Riis, Finsen's countryman, gives a fine sketch of the discoverer—Finsen himself is a hopeless invalid; Cleveland Moffet interestingly and fully explains the cure; Alfred Harmsworth tells of the progress of the cure in England; and Dr. George C. Hopkins what has been done in this country. Dr. Hopkins adds the most important item of all—his belief that, in the Finsen ray, in combination with the X-ray, may be found a cure for cancer as certain as the Finsen ray alone has already proved for lupus. This idea has already been put forward and worked on by the well-known American electro-therapeutist, Dr. W. J. Morton.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JANUARY 20, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

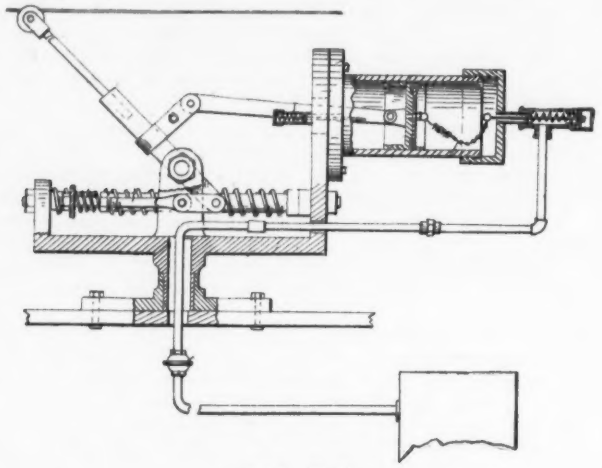
718,610. ELECTRIC CLOCK; W. J. Dudley, Bangor, Me. App. filed Aug. 20, 1902. Details.

718,619. ELECTRIC HEATING SYSTEM; E. E. Gold, New York, N. Y. App. filed Jan. 10, 1900. Heaters having main and auxiliary coils are arranged along a car in series and by means of suitable shunt circuits any of the main and auxiliary coils can be thrown into service.

718,632. ELECTRICAL FUSE OR JUNCTION BOX; M. H. Johnson, Utica, N. Y. App. filed May 31, 1902. A tablet carrying the distributing devices is arranged in the box in a manner to be readily removed and replaced when necessary.

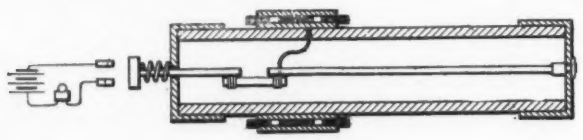
718,637. SECONDARY BATTERY; I. Kitsee, Philadelphia, Pa. App. filed April 28, 1900. A conducting grid having recesses in which are placed blocks built up of active material and conducting supports; any block can be removed and replaced at will.

718,660. THERMAL ELECTRIC CUT OUT; T. E. Scantlin, LaFayette, Ind. App. filed Sept. 5, 1901. A fusible portion of a circuit is arranged adjacent to an imperfect contact heating resistance.



718,678—Trolley.

718,678. TROLLEY; G. R. Tomb, Lorain, Ohio. App. filed May 21, 1902. The base of the pole is connected with a piston in a cylinder; air is admitted to the cylinder when the trolley jumps the wire and moves the piston to lower the pole.



718,797—Safety Fuse.

718,686. TELEPHONE SYSTEM: F. B. Wood, New York, N. Y. App. filed August 29, 1901. (See page 200.)

718,697. INDUCTION MOTOR; C. C. Chesney, Pittsfield, Mass. App. filed July 30, 1902. Separately formed conducting U-shaped pieces, the ends of which are connected to a conducting ring, are fixed upon the armature core.

718,774. ACCUMULATOR PLATE; W. Kraushaar, Neumuhl, Germany. App. filed June 20, 1902. The webs of the grid are provided with notches on opposite sides in staggered relation.

718,775. QUICK BREAK ELECTRICAL SWITCH; F. A. La Roche, New York, N. Y. App. filed Dec. 14, 1901. The switch bar, when closed, holds a spring under compression; a latch which locks the parts in this condition, can be released by a slight blow allowing the spring to act to quickly open the circuit.

718,797. SAFETY FUSE; J. Sachs, Hartford, Conn. App. filed Sept. 30, 1901. One of the fuse terminals is movable and under the tension of a spring, so that destruction of the fuse will be indicated by the displacement of the movable terminal.

718,828. PROCESS OF MAKING TAP-POLE PLUGS; A. Dickey, Niagara Falls, N. Y. App. filed December 2, 1901. (See Current News & Notes.)

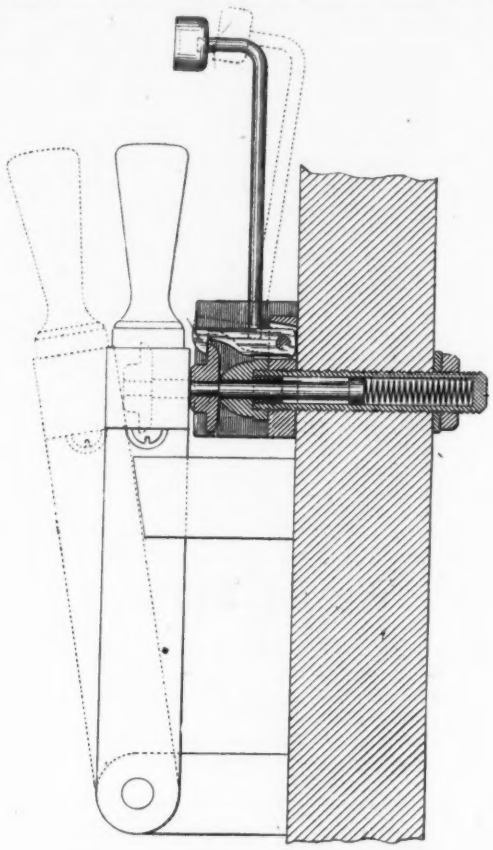
718,846. BATTERY CONNECTION; W. W. Keirstead, Grand Rapids, Mich. App. filed May 10, 1902. Details.

718,855. TELEPHONE SET; K. B. Miller, Chicago, Ill. App. filed August 23, 1901. (See page 200.)

718,891. METHOD OF REDUCING METALLIC OXIDS; E. G. Acheson, Niagara Falls, N. Y. App. filed December 4, 1900. (See page 198.)

718,892. ELECTRIC FURNACE; E. G. Acheson, Niagara Falls, N. Y. App. filed December 20, 1900. (See page 198.)

718,896. ELECTROTHERAPEUTIC APPARATUS; W. H. Ames, St. Louis, Mo. App. filed June 14, 1902. A blanket or sweat robe for man and animals having a heating resistance threaded through it and arranged in combination with suitable switching apparatus and resistances.



718,775—Quick Break Electrical Switch.

718,910. PROCESS OF CONTROLLING ELECTRIC MOTORS; W. H. Chapman, Portland Me. App. filed Oct. 22, 1902. Consists in connecting each armature terminal with each pole of the line through suitable resistance and simultaneously and equally increasing the resistance between one of said terminals and the positive pole of the line and decreasing the the resistance between said terminal and the negative pole of the line and decreasing the resistance between the other terminal and the positive pole and increasing the resistance between the latter terminal and the negative.

718,925. BLOCK SYSTEM FOR RAILWAYS; H. J. Fuller, Winchester, Mass. App. filed Mar. 5, 1901. The system comprises a single track railway divided into blocks by turn-outs and automatic mechanism for cutting the supply of current from a car when it reaches a turn-out until the arrival of another car at the turn-out.

718,927. RECOVERING TIN FROM TIN-SCRAP; R. H. Gould, Subiton, Eng. App. filed August 27, 1900. (See page 198.)

718,935. WATER-PURIFIER; J. Johnson, Minneapolis, Minn. App. filed September 23, 1902. (See Current News & Notes.)